ENERGY STRATEGY

Hulbert Road, Havant

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About Sadler Energy and Environmental Services Ltd.

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry from the concept and planning stage through to the completion of the project.

Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for energy efficiency, quality and practical on-site applications.

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1. Executive Summary

This Energy Strategy Report outlines the low-carbon design options proposed for a 100-dwelling residential development in Havant, in line with the planning requirements set by Havant Borough Council (HBC), East Hampshire District Council (EHDC), and the South Downs National Park Authority (SDNPA). The strategy focuses on ensuring compliance with Part L 2021 of the Building Regulations while supporting the developer's aspiration to achieve a minimum EPC rating of 'B' for all units.

A number of sustainable technology options have been modelled and evaluated using the SAP 2021 methodology to determine their effectiveness in reducing regulated energy use and carbon emissions. The assessment considers both fabric-first enhancements and renewable technologies including air source heat pumps (ASHPs), heat pump water cylinders, Sunamp heat batteries, mechanical ventilation with heat recovery (MVHR), and photovoltaic (PV) systems.

Technology Summary

- Option 1: Air Source Heat Pumps (ASHPs)
  ASHPs offer a highly efficient, low-carbon heating solution suitable for low-density housing layouts. This option delivers the highest overall carbon savings, with a site-wide average reduction of 61.94% over TER.
  PV required: 0.8 kWp

- Option 2: Electric Heating with Edel Heat Pump Cylinder
  This hybrid approach uses efficient hot water storage combined with electric space heating. While offering slightly lower performance than ASHPs, it still achieves an average 57.75% reduction in carbon emissions.
  PV required: 94.1 kWp

- Option 3: Electric Heating with Sunamp Heat Battery
  This option models direct electric heating with advanced thermal storage via Sunamp phase-change technology. It provides a 55.37% reduction in emissions.
  PV required: 245.4 kWp

- Option 4: Electric Heating with Sunamp and MVHR
  Incorporating MVHR enhances energy efficiency by recovering heat from ventilation exhaust air. This strategy offers a carbon saving of 54.35% across the site.
  PV required: 170.9 kWp

CO_2 Emissions and Renewable Energy Performance

Heating Options	% CO_2 Reduction (TER vs DER)	PV Installed (kWp)	% Energy from Renewables
Option 1: ASHP	61.94%	0.8	35.63%
Option 2: Electric Heating & Edel Cylinder	57.75%	94.1	33.84%
Option 3: Electric Heating & Sunamp Heat Battery	55.37%	245.4	29.32%
Option 4: Electric Heating, Sunamp Heat Battery and MVHR	54.35%	170.9	23.28%

Each option exceeds the baseline requirements of Part L 2021, demonstrating a strong commitment to sustainability and carbon reduction. The inclusion of high-performance fabric measures, low-carbon heating, and renewable generation ensures long-term operational energy efficiency and regulatory compliance.

All proposed strategies are capable of meeting or exceeding the planning targets and regulatory standards. The preferred option should be selected based on a balance of performance, cost, spatial feasibility (particularly for apartments), and future-proofing considerations. Final technical appraisals will be required at the detailed design stage to confirm system sizing, integration, and distribution.

2. Information and Background

This Energy Strategy has been prepared to demonstrate how the proposed development will exceed the environmental and sustainability performance expectations set by Havant Borough Council (HBC), East Hampshire District Council (EHDC), and the South Downs National Park Authority (SDNPA). It sets out the core low-carbon technologies, fabric improvements, and renewable energy measures that will enable the scheme to meet—and go beyond—relevant local policy requirements.

The primary objective of this strategy is to achieve full compliance with the policies outlined in the Local Plan and Core Strategy of the relevant authorities, while delivering a substantial reduction in the site's operational carbon emissions. In doing so, the development supports both local and national climate objectives, including the UK Government's legally binding commitment to achieving net-zero carbon emissions by 2050.

By incorporating advanced energy-efficient systems and on-site renewable generation—most notably air source heat pumps, heat pump water heaters, photovoltaic panels, and high-performance fabric design—the strategy presents a credible and future-ready route to energy resilience and environmental performance. Each element of the energy design has been considered in the context of long-term building performance, occupant wellbeing, and the minimisation of environmental impact.

This development aims to serve as a benchmark for sustainable residential design in the region, illustrating how modern planning and technology can be combined to deliver measurable environmental, social, and economic benefits for current and future communities.



Image 1: Site Plans

2.1 Planning Targets

When proposing a development of new residential dwellings in Havant, it's essential to consider the energy efficiency, sustainability, and renewable energy requirements set forth by the relevant local planning authorities: Havant Borough Council (HBC), East Hampshire District Council (EHDC), and the South Downs National Park Authority (SDNPA). Below is an overview of the key planning policies from each authority:

Havant Borough Council (HBC)

Core Strategy (2011) – Adopted Local Plan

- *The adopted Local Plan comprises the Core Strategy (2011) and the Site Allocations Plan (2014). These documents form the basis for planning decisions in the borough.havant.gov.uk*
- ***Policy CS1** – Health and Wellbeing: Emphasizes the importance of sustainable development that promotes health and well-being, including energy-efficient housing.*
- ***Policy CS11** – Protecting and Enhancing the Special Environment and Heritage of Havant Borough: Encourages the incorporation of renewable energy technologies in new developments, provided they do not harm the borough's character.*

Climate Change and Environment Strategy (2021–2026)

This strategy outlines HBC's commitment to addressing climate change through:

- *Improving energy efficiency in buildings.*
- *Supporting renewable energy initiatives.*
- *Encouraging sustainable construction practices.*
- *Developers are expected to align their proposals with these objectives to contribute to the borough's sustainability goals.*

East Hampshire District Council (EHDC)

Joint Core Strategy (2014)

The Joint Core Strategy provides the policy framework for development in EHDC areas outside the South Downs National Park. Key policies include:

- ***Policy CP24 – Sustainable Construction**: Requires new residential developments to meet Code for Sustainable Homes Level 4, focusing on energy efficiency and water conservation.*
- ***Policy CP26 – Water Resources/Water Quality**: Emphasizes the need for water-efficient design in new developments.*

Climate Change and Sustainable Construction Supplementary Planning Document (SPD) (2022)

This SPD provides guidance on implementing sustainable construction practices, including:

- *Incorporating renewable and low-carbon energy technologies.*
- *Enhancing building fabric efficiency.*
- *Promoting sustainable site layouts and landscaping.*
- *Developers should refer to this SPD to ensure their proposals meet EHDC's sustainability expectations.*

South Downs National Park Authority (SDNPA)

South Downs Local Plan (2019)
The Local Plan covers the entire National Park and sets out policies to conserve and enhance the park's natural beauty. Relevant policies include:

- ***Policy SD48 – Climate Change and Sustainable Use of Resources****: Requires developments to incorporate measures to mitigate and adapt to climate change, including energy efficiency and the use of renewable energy.*
- ***Policy SD49 – Renewable Energy****: Supports small-scale renewable energy schemes that are sensitively located and designed to avoid adverse impacts on the landscape.*

Sustainable Construction Supplementary Planning Document (SPD)
This SPD provides detailed guidance on achieving sustainable construction within the National Park, focusing on:

- *Reducing carbon emissions through energy-efficient design.*
- *Utilising renewable energy sources where appropriate.*
- *Ensuring developments are resilient to climate change impacts.*

3. Energy Efficiency – Demand Reduction

Energy efficiency and carbon emission rates have been calculated using SAP 2021, which produces metrics used for Building Regulations compliance, based on the predicted annual energy use per square meter of floor area for a dwelling, The metrics used in this report are:

- Dwelling Emissions Rate (DER): the predicted carbon dioxide emissions based on the fuels used to heat, light, cool and ventilate a dwelling, expressed in kgCO2/m2/yr.
- Dwelling Fabric Energy Efficiency: the predicted energy used to heat and cool a dwelling expressed in kWh/m2/yr.

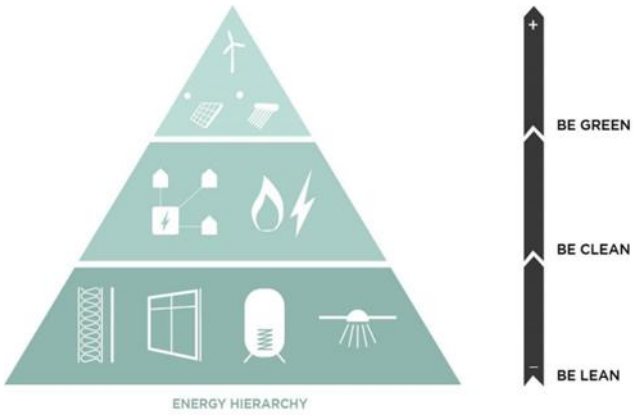
For each metric, a "target" is calculated by SAP based on a notional dwelling specification set in the Building Regulations. The dwelling energy metrics must be lower than these targets to achieve Building Regulation Part L compliance.

This energy strategy will outline carbon emission savings through fabric-first approaches and renewable technology options, with the aim to achieve low and zero carbon dwellings. Each option will be modelled in SAP and produce percentage savings on dwelling emission rates (DER) for properties vs target emission rates (TER).

3.1 Methodology

This report uses the energy hierarchy to minimise onsite carbon emissions, the stages are:

- Use Renewable Energy - assess the feasibility of renewable energy systems.
- Supply Energy Efficiently - use low-carbon technology to significantly reduce energy consumption.
- Use Less Energy - the incorporation of low energy design and passive measures to promise the reduction of energy use.



3.2 Building Energy Modelling

The site was modelled using SAP 2021 calculations (see SAP summary), to predict energy demands and CO2 emissions for compliance with the planning policy.

3.3 Energy Efficiency

To deliver the energy demand reduction required to meet and exceed Part L 2021 compliance, improvements to the fabric specification and heating systems of the dwellings forms the first stage of the energy hierarchy.

A fabric first approach has been adopted to minimise energy demand as much as practical. Energy efficiency features that were proposed include: Built form, Insulation Standards, Glazing, Heating Systems, Ventilation, Lighting, Controls, Heat Recovery, Free Cooling, and Equipment. In this chapter we have detailed the most effective energy efficient measures.

Three main sources of heat loss:

- Thermal Envelope
- Thermal Bridging
- Uncontrolled Air Leakage

3.4 Thermal Envelope

The dwellings on this development aim for fabric efficiency well above Part L standards, see Table 1.

Thermal Element	BR U-value (Part L 2021) W/m^{2}K	Proposed Design U-values W/m2K
Ground Floors	0.18	0.11
Exposed Floors	0.18	0.12
External wall	0.26	0.18
Plane Roof	0.16	0.09
External Doors	1.6	1.4
Windows & Glazed Doors	1.6	0.72

Table 1 – Proposed Fabric Standard

3.5 Thermal Bridging

Thermal bridging occurs at the junction between fabric elements, where the continuous insulation line is broken. Through careful detailing of junctions, it is possible to mitigate against the impact of thermal bridges.

The developments standard details ensure that the design of junctions minimises unnecessary bridging of the insulation layers, with avoidable heat loss being reduced wherever possible. Accurate calculation of these heat losses forms an integral part of the SAP calculations undertaken to establish energy consumption of the dwellings, and as such thermal modelling has been undertaken to assess the performance of all main building junctions.

The dwellings on this development aim for minimal thermal bridging, with thermal bridging for all blocks well below Building Regulations, see Table 2.

Thermal Bridging		
Non-repeating junctions have been designed and built to the following details:		
	Recognised construction details	**Default**
E1 Steel Lintels		0.05 Hi Therm lintels
E3 Sill		0.045 – CD00
E4 Jamb		0.051 - CD0028
E5 Ground floor		0.067 - CD0022
E20 Exposed floor	x	
E6 Intermediate floor between dwellings		0.00 - CD0029
E7 Party floor between dwellings		0.064 - C0030
E10 Eaves (insulation at ceiling)		0.098 - CD0033

E11 Eaves (insulation a rafter)		0.038 - CD0034
E12 Gable (insulation at ceiling)		0.097 - CD0031
E13 Gable (insulation at rafter)		0.084 - CD0032
E16 Corner		0.057 - CD0035
E17 Corner (Inverted)		-0.051 - CD0036
E18 Party wall between dwellings		0.062 - CD0037
E21 Inverted Exposed floor		0.084 - 0.941-14-E21
P1 Party wall to ground floor	x	
P2 Party wall to intermediate floor within dwelling	x	
P3 Party wall to intermediate floor between dwellings	x	
P4 Party wall to insulation at ceiling level	x	
R1 - Head of roof windows	x	
R2 - Sill of roof windows	x	
R3 - Jamb of roof windows	x	

Table 2 – Thermal Bridging

3.6 Uncontrolled Air Leakage and Ventilation

As buildings become more insulated, uncontrolled air leakage represents an increasing proportion of dwelling heat loss. As such, it is critical to ensure that any unwanted leakage is minimised. Table 3 details the air permeability at the Hulbert Road development for all dwellings.

Under current Building Regulations (2021) a dwelling must have an infiltration rate of less than 8m^3/hm^2@50Pa. The air permeability targets for Hulbert Road will be much lower than 8, as seen in Table 3.

Building	Air Permeability m^3/hm^2@50Pa
Dwellings	4

Table 3 – Air Permeability

3.7 Lighting

Low energy fittings are defined as fittings that can only be used with lamps having a luminous efficacy greater than 100 lumens per circuit watt. All buildings will have 100% low energy lights fitted internally.

Externally, property will have low energy light fitting or standards with light and motion sensors.

3.8 Primary Energy

The heating and energy systems proposed for this development are designed to prioritise occupant comfort, enhance energy efficiency, and reduce overall energy consumption. A range of heating options have been modelled to reflect potential configurations within the dwellings, each incorporating varying levels of renewable integration and user control.

The following options have been assessed:

Option 1: Ideal Logic Air Heat Pump (4kW, 45° C Flow Temperature)
This option utilises a low-temperature air source heat pump (ASHP), providing efficient space heating throughout the apartment. The 45° C flow temperature ensures high seasonal performance while maintaining comfort, with centralised heating control across the dwelling. This configuration supports the development's low-carbon objectives and complies with SAP efficiency standards.

Option 2: Electric Panel Heaters & Dimplex EDEL Hot Water Cylinder with PV
This dual system pairs electric panel heaters for space heating with a dedicated air source heat pump cylinder (Dimplex EDEL) for hot water. The system also incorporates roof-mounted photovoltaic (PV) panels, which generate on-site renewable electricity.

Key benefits include:

- Room-by-room zoning, allowing residents to independently control heating in each space.
- Reduced energy waste, as only occupied rooms need to be heated.
- Integration with PV, improving energy efficiency and reducing grid reliance.

Option 3: Electric Panel Heaters & Sunamp Thermal Storage with PV
This system combines electric panel heaters for space heating with a Sunamp thermal storage cylinder for hot water, supported by rooftop solar PV panels.

Notable features:

- Thermal storage improves time-of-use flexibility and can store renewable energy generated during the day.
- Zoned electric heating maximises user control and energy efficiency.
- PV integration contributes to renewable energy targets and aligns with the development's sustainability strategy.

Option 4: Electric Panel Heaters, Sunamp Thermal Storage, MVHR and with PV
This system combines electric panel heaters for space heating with a Sunamp thermal storage cylinder for hot water, supported by rooftop solar PV panels.

Notable features:

- Thermal storage improves time-of-use flexibility and can store renewable energy generated during the day.
- Zoned electric heating maximises user control and energy efficiency.
- Mechanical Ventilation with Heat Recovery to all dwellings
- PV integration contributes to renewable energy targets and aligns with the development's sustainability strategy.

All heating strategies emphasise:

- Zoned control, allowing for targeted heating and improved resident comfort.
- On-site renewable energy generation to lower carbon emissions.
- Reduced operational energy demand, aligning with national and local sustainability standards.

These systems have been selected to provide flexible, future-proofed heating solutions while supporting low-carbon development principles and minimising energy costs for residents.

3.9 Passive Design Measures and Overheating Risk Mitigation

To help reduce energy demand, the dwellings have been designed using passive design principles wherever practical. This includes carefully considering the building orientation and site layout to maximise sunlight during colder months (solar gain).

The use of materials with high thermal mass, such as traditional masonry, helps regulate indoor temperatures. These materials take longer to heat up during the day, acting as a “heat sink” by absorbing excess heat and reducing the risk of overheating. At night, they slowly release the stored heat, providing a small amount of passive heating. This process smooths temperature fluctuations, reducing the need for instant heating or cooling.

Additional passive and active measures to reduce energy demand and balance heat gains include:

- Solar control glazing: Glazing with a solar transmittance value (g-value) of 0.51 has been specified. This balances winter solar gain with limiting summer heat buildup, as determined in the Part O overheating assessment.
- Minimising overshading: The design reduces shading from nearby buildings and trees to maximise natural light.
- Efficient hot water systems: Where required, highly insulated hot water cylinders with low heat loss values are specified, along with fully insulated pipework.
- Energy-efficient lighting: All lighting installed will meet or exceed a minimum efficiency of 100 lumens per watt.

The development uses a mix of passive and purge ventilation strategies, depending on the house or block design. In some areas near the railway line, acoustic concerns mean certain windows cannot be opened, so mechanical ventilation will be installed to cool the buildings effectively. These strategies ensure that active cooling systems, like air conditioning, are not needed.

By incorporating these measures, the development is designed to be more resilient to climate change while minimising the risk of overheating. This is especially important as homes become more insulated and airtight to meet energy efficiency standards.

3.10 Water Efficiency

It is proposed that all dwellings achieve a minimum water efficiency standard of 110 litres/person/day as the Local Plan requires minimum water consumption. It is recommended that maximum water consumption criteria, as stated in Table 2 of approved document Part G is followed, see Table 4 below.

Water Fitting	Maximum Consumption
WC	4/2.6 litres dual flush
Shower	8 l/min
Bath	170 litres
Basin Taps	5 l/min
Sink Taps	6 l/min
Dishwasher	1.25 l/place setting
Washing Machine	8.17 l/kilogram dry load

Table 4 - (Part G2 Table 2) Maximum fittings consumption optional requirement level



4. Energy Efficiency Low and Zero Carbon (LZC) Energy Generation and Results

The energy hierarchy requires that the feasibility of on-site renewables technology be investigated. This section reviews each of the technologies that are to be considered on a new development, with the most feasible method being selected.

Technology	Checklist	Comments	Suitable Technology
Solar Photovoltaic 	Will the buildings have an east to west (through south) facing roof or flat roof?	The viability of PV installation will need to be reviewed for certain design options due to potential limitations in available roof space.	Suitable, photovoltaic (PV) panels have been prioritised, as they offer greater flexibility, higher energy yield potential, and a more significant impact on regulated energy use and carbon emissions.
	Are roofs free from overshadowing for most of the day from buildings or other structures?	Surrounding dwelling heights do not exceed the height of the proposed dwellings. Sufficient distance from the existing established trees which are to be retained.	
	Is the building in a conservation area?	No	
Solar thermal 	Will the buildings have a year-round demand for hot water?	Yes	Solar hot water has not been modelled for this development due to its limited contribution to overall energy and carbon reduction targets, as well as practical integration challenges with modern low-carbon heating systems such as heat pumps.
	Will the buildings have an open aspect south east to south west facing roof of at least 4m^2?	As the development mainly consists of apartments, there is not enough roof space to provide hot water via solar thermal for all the flats.	
	Is there space for hot water cylinder near the panels?		
	Is the building in a conservation area?	No	
Biomass 	Is there a local supply and space for storage of biomass fuel or can one be set up?	Biomass has been considered but deemed unsuitable for this development due to several key constraints. These include local air quality concerns associated with biomass emissions, particularly in Air Quality Management Areas (AQMAs); logistical challenges related to fuel delivery and on-site storage; and increased maintenance and operational complexity.	Unsuitable, the availability of more efficient, lower-impact technologies—such as air source heat pumps and solar photovoltaics—offers more practical and sustainable alternatives for meeting carbon reduction targets on this site
	Is a room heater or boiler required	No boiler room is provided to accommodate the storage of biomass fuel, such as wood pellets or chips. Additionally, the storage space must be accessible for delivery vehicles.	
CHP 	Is a communal heat network proposed?	There is no district system available/proposed.	Unsuitable
Ground Source Heating 	Will there be room for a horizontal buried pipe?	Require a substantial amount of land for the installation of horizontal ground loops. This can be a constraint in urban or densely populated areas where space is limited.	Considered but due to issued with the ground not suitable on this development.
	Is the ground suitable for vertical pipe system?	Further assessment of ground conditions required. Local regulations may restrict drilling or excavation needed for GSHP installations. Permits may be required.	
Air Source 	Is there sufficient room within the dwelling to accommodate internal unit.	The installation of external ASHP units presents significant challenges in this development. If required, careful consideration would need to be given to their placement–either mounted on the building's exterior façade or positioned on a	Yes, the inclusion of ASHP hot water cylinders is considered appropriate and has been incorporated into

		suitably sized flat roof area. In either case, appropriate access provisions must be incorporated into the design to ensure safe installation and ongoing maintenance, while also addressing potential visual and acoustic impacts.	the proposed energy strategy as option 2. Option 1 is an ASHP for heating and hot water.
	Is a low temperature heat emitter (i.e. underfloor heating) proposed?	Oversized radiators required to maintain heat output with low flow temperatures	
	Other problems?	None	
District Heating 	Is there district heating situated close the site.	Currently there is no district heating or cooling systems	Unsuitable

4.1 Air Source Heat Pumps – Option 1



Air Source Heat Pumps (ASHPs) use an external heat exchanger unit to extract thermal energy from the ambient air. These systems can operate in sub-zero temperatures, although their Coefficient of Performance (CoP) decreases as external temperatures fall. The heat exchanger must be installed in free air—typically on a ground-mounted plinth or wall bracket. The unit features a fan that may emit a low-level hum during operation; as such, careful consideration of placement is essential to mitigate potential noise or spatial impacts.

The proposed development comprises low-density housing, with each dwelling benefiting from a private garden - providing favourable conditions for ASHP installation. However, apartments may present spatial or acoustic constraints, and further consideration will be required to determine the suitability of ASHPs for these units.

For the purposes of supporting calculations, an Ideal Logic Air source heat pump has been modelled. At the detailed design stage, final sizing will be required to ensure that each heat pump meets the peak heating demand of its respective dwelling.

When deployed alongside complementary energy efficiency and renewable measures, ASHPs are capable of delivering over a 60% reduction in carbon emissions, in line with the SAP 2021 methodology.

4.1.1 Considerations

Air Source Heat Pumps	
Potential Advantages	**Risks & Disadvantages**
• Offsets the high carbon content of grid electricity used for lighting, appliances, pumps, and fans. • Offers an average carbon saving of approximately 65% compared to traditional gas boilers. • Longer lifespan than conventional boilers—typically up to 20 years with proper maintenance. • High operational efficiency: typically uses only ~25% of the energy required by a gas boiler for equivalent output.	• Poor design or installation may lead to reduced performance (e.g., in shaded or restricted locations). • Requires sufficient external space for the unit, which may not be feasible for all dwellings. • Safe and practical access must be ensured for regular servicing and maintenance.
Conclusion	
Air Source Heat Pumps will surpass the 19% target over TER could be suitable for the dwellings but need to be considered further.	

4.1.2 Site Assessment

The site layout and dwelling typologies indicate good potential for ASHP implementation across the development. A detailed technical appraisal will be required at the next design stage to ensure appropriately sized units can be effectively and sensitively integrated, providing reliable space heating and hot water.

An Ideal Logic Air heat pump has been modelled for the initial energy assessment. Results indicate a site-wide carbon reduction of approximately 61.94% over the TER baseline in SAP 2021, exceeding regulatory targets (see Table 5).

Dwelling Type	Qty	TER	DER	% Reduction
2B3P FOG HT 1	4	15.67	4.62	70.52
2B4P House HT 2	15	11.43	4.44	61.15
3B5P House HT 5	17	10.38	4.13	60.21
4B6P House HT 6	4	9.79	3.85	60.67
2B3P House HT 8	7	13.5	4.94	63.41
2B4P House HT 9	9	12.56	4.69	62.66
3B4P House HT 10	21	11.31	4.4	61.10
3B5P House HT 11	8	11.46	4.36	61.95
4B6P House HT 12	4	10.15	3.99	60.69
3B4P House HT 13	9	12.06	4.55	62.27
4B6P House HT 14	2	10.14	4.15	59.07
Total	**100**	**11.56**	**4.40**	**61.94**

Table 5 - Improvements over 2021 Building Regulations

4.2 Heat Pump Hot Water Cylinder - Option 2

Heat pump water heaters are a relatively new and highly efficient technology for delivering stored hot water in both houses and apartment buildings. They operate using the same principles as air source heat pumps, extracting thermal energy from the surrounding air and amplifying it via a vapour compression cycle. This enables them to deliver significantly more heat output than the electrical energy they consume.

For example, a typical system can achieve a Coefficient of Performance (CoP) of 3.0 - meaning that for every 1kW of electricity used, approximately 3kW of thermal energy is produced. This makes heat pump water heaters substantially more energy-efficient and cost-effective than traditional direct electric cylinders that rely on immersion heaters. Products such as the Dimplex Edel represent a practical and efficient solution, offering lower energy bills while maintaining reliable domestic hot water provision.

Installation Requirements

One of the key benefits of heat pump water heaters is their relatively simple installation requirements. These systems typically require:

- A standard electrical connection
- Two small duct runs (for air intake and exhaust) terminating at an external wall
- A plant space comparable in size to a traditional hot water cylinder

Proper positioning of the ductwork is critical to ensure compliance with ventilation and clearance regulations. Care must be taken to avoid interference with windows, vents, or other building services.

4.2.1 Site Assessment

A detailed technical appraisal will be required during the next design stage to confirm that appropriately sized units can be effectively integrated within each dwelling, ensuring reliable hot water provision while maintaining layout and spatial efficiency.

Dwelling Type	Qty	TER	DER	% Reduction
2B3P FOG HT 1	4	15.5	4.89	68.45
2B4P House HT 2	15	11.28	4.77	57.71
3B5P House HT 5	17	10.25	4.54	55.71
4B6P House HT 6	4	9.67	4.44	54.08
2B3P House HT 8	7	13.3	5.48	58.80
2B4P House HT 9	9	12.39	5.21	57.95
3B4P House HT 10	21	11.15	4.96	55.52
3B5P House HT 11	8	11.32	4.65	58.92
4B6P House HT 12	4	10.04	4.51	55.08
3B4P House HT 13	9	11.91	4.7	60.54
4B6P House HT 14	2	10.02	4.49	55.19
Total	**100**	**11.41**	**4.82**	**57.75**

Table 6 - Improvements over 2021 Building Regulations

4.3 Heat Batteries - Options 3 and 4

Recent advances in hot water storage technology have significantly improved the thermal performance of domestic hot water systems, leading to reduced energy consumption. High-efficiency hot water cylinders and heat batteries now offer lower standing heat losses and better integration with renewable technologies, making them a strong choice for decarbonised residential developments.

Cylinder	Size	Loss – Liters kWh/24h
Megaflow Eco	145	1.18
OSO Delta Coil	150	0.94
Sunamp	150	0.67

Table 7 – Cylinder Performance

The Sunamp system, a phase-change material (PCM)-based heat battery, demonstrates the lowest standing heat loss of the systems assessed. It has been modelled as part of the SAP 2021 analysis to support the developer's ambition of achieving a minimum EPC rating of 'B' across all dwellings.

Sunamp cylinders offer a compact and highly efficient solution for domestic hot water storage. These systems can be charged flexibly using a variety of renewable or low-carbon sources, including air source heat pumps, solar PV, or off-peak grid electricity - enabling demand-side energy flexibility and maximising on-site renewable generation.

4.3.1 Site Assessment - Option 3 - Electric Heating with Sunamp Heat Battery

This scenario assumes the use of direct electric space heating in conjunction with a Sunamp heat battery for domestic hot water storage. The results in Table 8 below demonstrate a notable improvement in energy performance over the Part L 2021 baseline, with a total average carbon reduction of 55.37% across the site.

Dwelling Type	Qty	TER	DER	% Reduction
2B3P FOG HT 1	4	15.67	5.09	67.52
2B4P House HT 2	15	11.43	4.06	64.48
3B5P House HT 5	17	10.38	5.1	50.87
4B6P House HT 6	4	9.79	3.53	63.94
2B3P House HT 8	7	13.5	6.08	54.96
2B4P House HT 9	9	12.53	5.76	54.03
3B4P House HT 10	21	11.31	5.58	50.66
3B5P House HT 11	8	11.46	5.35	53.32
4B6P House HT 12	4	10.13	4.98	50.84
3B4P House HT 13	9	12.06	5.51	54.31
4B6P House HT 14	2	10.14	4.87	51.97
Total	**100**	**11.56**	**5.16**	**55.37**

Table 8 - Improvements over 2021 Building Regulations

4.3.2 Site Assessment - Option 4 - Electric Heating, Sunamp Heat Battery and MVHR

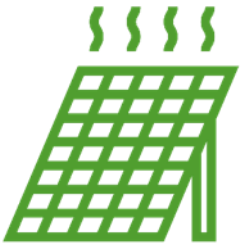
Option 4 builds on the previous scenario by incorporating Mechanical Ventilation with Heat Recovery (MVHR) to further enhance thermal performance and reduce space heating demand. The integration of MVHR aims to improve air quality while recovering otherwise wasted heat from exhaust air.

The combined strategy continues to show strong performance, achieving a total average carbon reduction of 54.35% over the Part L 2021 baseline (see Table 9).

Dwelling Type	Qty	TER	DER	% Reduction
2B3P FOG HT 1	4	15.67	5.34	65.92
2B4P House HT 2	15	11.43	4.57	60.02
3B5P House HT 5	17	10.38	5.06	51.25
4B6P House HT 6	4	9.79	4.04	58.73
2B3P House HT 8	7	13.5	6.26	53.63
2B4P House HT 9	9	12.53	5.85	53.31
3B4P House HT 10	21	11.31	5.46	51.72
3B5P House HT 11	8	11.46	5.48	52.18
4B6P House HT 12	4	10.13	4.95	51.14
3B4P House HT 13	9	12.06	5.65	53.15
4B6P House HT 14	2	10.14	4.91	51.58
Total	**100**	**11.56**	**5.28**	**54.35**

Table 9 - Improvements over 2021 Building Regulations

4.4 Photovoltaic Panels



Photovoltaic (PV) panels generate electricity by converting daylight into usable energy. While they do not require direct sunlight to function, making them well-suited to the UK's climate, they operate most efficiently under clear, sunny conditions. Shading, orientation, and roof pitch all influence performance, with south-facing roofs at optimal tilt angles providing the highest yields.

One operational consideration is the timing of generation. PV panels produce the most electricity during daylight hours, which may not align with residential peak demand typically occurring in the early morning and evening. Without on-site battery storage, surplus electricity generated during the day is exported to the grid. The integration of battery systems is under further consideration by the developer to maximise self-consumption.

Despite these factors, the proposed PV capacity under each option is sufficient to offset a significant portion of emissions associated with conventional fossil fuel use. When deployed alongside efficient heating technologies, such as air source heat pumps and a robust fabric-first approach, this strategy provides a clear trajectory towards net-zero operational carbon for each dwelling and contributes meaningfully to broader decarbonisation goals.

Solar Photovoltaic	
Potential Advantages	**Risks & Disadvantages**
• The technology offsets the high carbon content of grid supplied electricity used for lighting, pumps and fans, appliances, and equipment • Mature and well proven technology that is relatively easily integrated into building fabric • Solar resource is not limited by energy loads of the dwelling as any excess generation can be transferred to the national grid • PV systems generally require very little maintenance • Significantly lower emissions when calculated using updated SAP 10.1 emissions factors	• Poor design and installation can lead to lower-than-expected yields (e.g., from shaded locations) • Installation is restricted to favorable orientations • Occupiers may not benefit from Feed in Tariff payments where the contract is held by a landlord • Safe access must be considered for maintenance and service checks • Visual impact may be a concern in special landscape designations (e.g., AONB) • Reflected light may be a concern in some locations
Conclusion	
PV panels are considered technically feasible and should be positioned to make use of favourable roof orientations to maximise energy generation.	

4.4.1 Summary of PV

The development has been designed with consideration for the proposed fabric specification to achieve the required energy performance:

Options	Site Wide PV demand to achieve a 'B' on all dwellings (kWp)
Option 1: ASHP	0.8
Option 2: Electric Heating & Edel Cylinder	94.1
Option 3: Electric Heating & Sunamp Heat Battery	245.4
Option 4: Electric Heating, Sunamp Heat Battery and MVHR	170.9

The proposed solar photovoltaic (PV) system will be distributed across the development to ensure that each dwelling benefits directly from the renewable energy generated. This will be achieved through the installation of dedicated inverters connected to individual dwellings. Each unit will be individually metered, enabling residents to utilise the electricity produced by their allocated PV panels, with energy consumption and savings reflected directly on their personal energy accounts.

For each option presented in this report, the PV system has been designed to be appropriately sized and integrated to maximise on-site renewable energy generation and align with the specific layout and orientation of the proposed units.

5. Energy and CO2 Savings

The energy performance and associated carbon emissions of all dwellings within this development have been assessed in line with SAP 2021 methodology, ensuring compliance with the latest Part L 2021 Building Regulations. As part of this assessment, comprehensive SAP calculations have been undertaken for each dwelling type included in the scheme.

To determine compliance, we calculated the Target Emission Rate (TER) for each unit and compared it to the Dwelling Emission Rate (DER) following the integration of energy-efficient measures. The resulting percentage improvement illustrates the effectiveness of the selected technologies in reducing emissions.

The development adopts a low-carbon strategy, integrating renewable technologies such as heat pump water cylinders and a roof-mounted photovoltaic (PV) system. These measures collectively contribute to reducing regulated energy consumption, lowering carbon output, and enhancing overall energy efficiency across the site.

5.1 CO_2 Emission Sitewide Savings

A summary of the total sitewide carbon savings achieved through these technologies is presented in Table 10 below.

Heating Options	TER kgCO2/yr/m2	DER kgCO2/yr/m2	% Improvement Over Building Regulations	PV Installed kWp
Option 1: ASHP	11.56	4.40	61.94	0.8
Option 2: Electric Heating & Edel Cylinder	11.41	4.82	57.75	94.1
Option 3: Electric Heating & Sunamp Heat Battery	11.56	5.16	55.37	245.4
Option 4: Electric Heating, Sunamp Heat Battery and MVHR	11.56	5.28	54.35	170.9

Table 10 – CO_2 Savings

5.2 Percentage Energy provided by Renewables

Table 11 below summarises the percentage of energy provided by renewable energy.

Heating Options	Total Base Case energy kWh/year	Total Primary energy kWh/year	% provided by renewables
Option 1: ASHP	3776.44	2430.77	35.63
Option 2: Electric Heating & Edel Cylinder	3721.55	2462.29	33.84
Option 3: Electric Heating & Sunamp Heat Battery	3778.05	2670.48	29.32
Option 4: Electric Heating, Sunamp Heat Battery and MVHR	3778.05	2898.62	23.28

Table 11 – Energy provided by Renewables

6. Conclusion

This Energy Strategy demonstrates that the proposed residential development has been carefully designed to meet and exceed the energy and sustainability expectations set by Havant Borough Council (HBC), East Hampshire District Council (EHDC), and the South Downs National Park Authority (SDNPA). Through the implementation of a robust fabric-first approach, alongside the integration of low-carbon technologies and on-site renewable energy generation, the scheme not only complies with the relevant policies outlined in the Local Plan and Core Strategy but also supports the UK's broader decarbonisation goals.

A range of energy strategies have been modelled, incorporating air source heat pumps, heat pump water heaters, Sunamp heat batteries, mechanical ventilation with heat recovery (MVHR), and solar photovoltaic (PV) systems. Each option achieves substantial reductions in carbon emissions, with all scenarios delivering performance well in excess of the Part L 2021 baseline requirements. Depending on the selected technology package, site-wide carbon savings range from 54% to over 61%, with renewable energy contributions of up to 35% of total demand.

The strategy aligns with and satisfies key planning requirements, including:

- Delivery of a minimum EPC rating of 'B' across all dwellings;
- Compliance with Building Regulations Part L 2021;
- Demonstrable carbon emissions reductions in accordance with local and regional energy policies;
- Promotion of low-carbon heating and renewable energy in line with the national net-zero 2050 trajectory.

The proposed approach ensures that the development is not only energy-efficient and environmentally responsible but also future-proofed against evolving regulatory standards. It contributes positively to climate resilience, occupant wellbeing, and long-term operational savings - setting a strong precedent for sustainable residential development in the region.

APPENDIX A – Full SAP Calculations

Full SAP Calculation Printout

Property Reference	HT 1 Havant	**Issued on Date**	22/06/2025
Assessment Reference	2B3P FOG ASHP	**Prop Type Ref**	2B3P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.62	**TER**	15.67
Environmental	96 A	**% DER < TER**			70.52
CO_2 Emissions (t/year)	0.28	**DFEE**	49.58	**TFEE**	53.07
Compliance Check	See BREL	**% DFEE < TFEE**			6.57
% DPER < TPER	39.43	**DPER**	49.97	**TPER**	82.50

Assessor Details	Mrs. Rebecca Lennon	**Assessor ID**	P627-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500 (1b)	x	2.4000 (2b)	=	12.3600	(1b) - (3b)
First floor	66.9100 (1c)	x	2.6000 (2c)	=	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.3260	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7890.7500	(34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.5025 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E10	Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12	Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1	Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3	Sill	9.0000	0.0450	0.4050
E4	Jamb	29.4000	0.0510	1.4994
E6	Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16	Corner (normal)	20.0000	0.0570	1.1400
E20	Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.9845 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	(38)
Heat transfer coeff	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	(39)

Average = Sum(39)m / 12 = 95.5125

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	(40)
HLP (average)												1.3255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2951 (42)
Hot water usage for mixer showers

62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day) 117.5885 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893	(44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739	(45)

Energy content (annual) Total = Sum(45)m = 1953.1211
Distribution loss (46)m = 0.15 x (45)m

30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)

Total per year (kWh/year) = Sum(64)m = 2489.1601 (64)
12Total per year (kWh/year) 2489 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

103.7843	92.1710	98.6985	88.4133	86.8658	79.5171	79.2820	81.6661	81.7366	89.6742	93.5889	102.8461	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	103.0417	114.0819	103.0417	106.4764	103.0417	106.4764	103.0417	103.0417	106.4764	103.0417	106.4764	103.0417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0564	204.1531	198.8695	187.6212	173.4223	160.0773	151.1621	149.0653	154.3490	165.5973	179.7962	193.1411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)	139.4951	137.1592	132.6592	122.7963	116.7551	110.4404	106.5619	109.7662	113.5231	120.5298	129.9846	138.2340	(72)
Total internal gains	502.0194	512.8204	491.9966	474.3202	450.6453	434.4204	418.1919	419.2995	431.7747	446.5950	473.6834	491.8431	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	19.6403	0.3900	0.0000	0.7700	58.2130	(76)
West	6.0400	19.6403	0.3900	0.0000	0.7700	35.6237	(80)

Solar gains	93.8367	183.5645	302.3046	440.8933	540.3313	553.1252	526.5978	452.3397	351.5928	217.8148	117.0034	77.1668	(83)
Total gains	595.8561	696.3849	794.3012	915.2134	990.9766	987.5456	944.7896	871.6392	783.3675	664.4098	590.6867	569.0098	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	
alpha	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	
util living area	0.9465	0.9215	0.8784	0.7945	0.6765	0.5331	0.4111	0.4556	0.6525	0.8421	0.9241	0.9519	(86)
Living	18.3900	18.7318	19.2605	19.9151	20.4485	20.7853	20.9193	20.8930	20.6256	19.9019	19.0211	18.3093	
Non living	16.8210	17.2485	17.9051	18.6976	19.3121	19.6646	19.7808	19.7637	19.5210	18.7061	17.6205	16.7197	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.6648	18.7318	19.2605	19.9151	20.4485	20.7853	20.9193	20.8930	20.6256	19.9019	19.0211	18.6857	(87)
Th 2	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	(88)
util rest of house	0.9379	0.9092	0.8592	0.7619	0.6246	0.4562	0.3125	0.3546	0.5797	0.8090	0.9101	0.9442	(89)
MIT 2	18.6250	17.2485	17.9051	18.6976	19.3121	19.6646	19.7808	19.7637	19.5210	18.7061	17.6205	17.2786	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.1323	17.9722	18.5664	19.2917	19.8666	20.2114	20.3363	20.3147	20.0600	19.2895	18.3039	17.9651	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1323	17.9722	18.5664	19.2917	19.8666	20.2114	20.3363	20.3147	20.0600	19.2895	18.3039	17.9651	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9320	0.8843	0.8342	0.7451	0.6268	0.4829	0.3570	0.3987	0.5957	0.7912	0.8864	0.9281	(94)
Useful gains	555.3550	615.8125	662.6456	681.9537	621.1484	476.9160	337.3204	347.4838	466.6300	525.6565	523.6013	528.0951	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1416.6737	1248.5625	1152.4969	992.5361	780.0112	535.9613	356.8619	373.9051	569.2514	829.9608	1070.1138	1314.7435	(97)
Space heating kWh	640.8211	425.2080	364.4493	223.6193	118.1939	0.0000	0.0000	0.0000	0.0000	226.4024	393.4890	585.2664	(98a)
Space heating requirement - total per year (kWh/year)												2977.4493	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	640.8211	425.2080	364.4493	223.6193	118.1939	0.0000	0.0000	0.0000	0.0000	226.4024	393.4890	585.2664	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2977.4493	
Space heating per m2											(98c) / (4) =	41.3190	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 262.4951 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	640.8211	425.2080	364.4493	223.6193	118.1939	0.0000	0.0000	0.0000	0.0000	226.4024	393.4890	585.2664	(98)
Space heating efficiency (main heating system 1)	262.4951	262.4951	262.4951	262.4951	262.4951	0.0000	0.0000	0.0000	0.0000	262.4951	262.4951	262.4951	(210)
Space heating fuel (main heating system)	244.1269	161.9870	138.8404	85.1899	45.0271	0.0000	0.0000	0.0000	0.0000	86.2501	149.9034	222.9628	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)
Efficiency of water heater												183.4483	(216)
(217)m	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	(217)
Fuel for water heating, kWh/month	135.2546	119.5920	126.9166	111.1804	107.5177	96.5956	95.0846	98.9931	100.2343	112.1219	119.6654	133.7164	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.1513	1.9431	2.1513	2.0819	2.1513	2.0819	2.1513	2.1513	2.0819	2.1513	2.0819	2.1513	(231)
Lighting	25.7918	20.6911	18.6301	13.6492	10.5430	8.6137	9.6177	12.5015	16.2382	21.3053	24.0643	26.5086	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.6657	-17.9097	-31.0813	-41.0624	-48.7810	-46.0048	-45.1389	-39.9256	-31.4449	-22.3803	-12.4881	-8.8132	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.6806	-4.4013	-11.0026	-20.5242	-31.2606	-34.1760	-33.3638	-26.1279	-16.6288	-7.2958	-2.5042	-1.2778	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 1134.2876 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.4483

Water heating fuel used 1356.8727 (219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 2.3400, total flow = 21.0000, SFP = 0.1114)		
mechanical ventilation fans (SFP = 0.1114)	25.3297	(230a)
Total electricity for the above, kWh/year	25.3297	(231)
Electricity for lighting (calculated in Appendix L)	208.1547	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-545.9391	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2178.7055	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	907.4301	0.1626	147.5602	(261)
Space heating - main system 1 (low-rate cost)	226.8575	0.1365	30.9689	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	949.8109	0.1479	140.4793	(264)
Water heating - low rate cost	407.0618	0.1241	50.5290	(264)
Space and water heating			369.5373	(265)
Pumps, fans and electric keep-hot	25.3297	0.1432	3.5147	(267)
Energy for lighting	208.1547	0.1490	31.0192	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.6957	0.1360	-48.3854	
PV Unit electricity exported	-190.2435	0.1204	-22.8968	
Total			-71.2822	(269)
Total CO2, kg/year			332.7889	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6200	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	907.4301	1.2850	1457.5849	(275)
Space heating - main system 1 (low-rate cost)	226.8575	1.4939	338.9043	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	949.8109	1.5529	1474.9254	(278)
Water heating - low rate cost	407.0618	1.4442	587.8840	(278)
Space and water heating			3859.2986	(279)
Pumps, fans and electric keep-hot	25.3297	1.5335	38.3227	(281)
Energy for lighting	208.1547	1.5547	323.6274	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.6957	1.5073	-536.1409	
PV Unit electricity exported	-190.2435	0.4415	-83.9842	
Total			-620.1251	(283)
Total Primary energy kWh/year			3601.1236	(286)
Dwelling Primary energy Rate (DPER)			49.9700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500 (1b)	x	2.4000 (2b)	=	12.3600	(1b) - (3b)
First floor	66.9100 (1c)	x	2.6000 (2c)	=	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.3260	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1610	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4110	(18)

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3494 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4454	0.4367	0.4280	0.3843	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3930	0.4105	(22b)
Effective ac	0.5992	0.5954	0.5916	0.5738	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5772	0.5843	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			6.4300	1.0000	6.4300			(26a)
TER Opening Type			11.5900	1.1450	13.2710			(27)
Heatloss Floor 1			5.1600	0.1300	0.6708			(28a)
Exposed floor			61.4500	0.1300	7.9885			(28b)
External Wall 1	90.4400	18.0200	72.4200	0.1800	13.0356			(29a)
Sheltered wall	27.3000		27.3000	0.1800	4.9140			(29a)
External Roof 1	66.9100		66.9100	0.1100	7.3601			(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.6700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.5025 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	22.2000	0.0600	1.3320
E12 Gable (insulation at ceiling level)	12.0000	0.0600	0.7200
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0500	0.4500
E4 Jamb	29.4000	0.0500	1.4700
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0900	1.8000
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3725 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 67.0425 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.8436	36.6067	36.3746	35.2841	35.0800	34.1302	34.1302	33.9543	34.4961	35.0800	35.4928	35.9243	(38)
Heat transfer coeff	103.8861	103.6492	103.4171	102.3265	102.1225	101.1727	101.1727	100.9968	101.5386	102.1225	102.5353	102.9668	(39)
Average = Sum(39)m / 12 =												102.3256	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4417	1.4384	1.4352	1.4200	1.4172	1.4040	1.4040	1.4016	1.4091	1.4172	1.4229	1.4289	(40)
HLP (average)												1.4200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2951 (42)
Hot water usage for mixer showers

62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day) 117.5885 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893	(44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739	(45)
Energy content (annual)										Total = Sum(45)m =		1953.1211	
Distribution loss (46)m = 0.15 x (45)m	30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.3423	225.0075	239.0464	209.9779	203.4594	183.2224	180.6512	187.8211	189.8976	211.9057	225.5435	251.5205	(62)
WWHRS	-28.6641	-25.3508	-26.5459	-21.9810	-20.4855	-17.5296	-16.4312	-17.4729	-18.1368	-21.3813	-24.2224	-28.1333	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	225.6782	199.6567	212.5005	187.9969	182.9739	165.6928	164.2200	170.3482	171.7607	190.5245	201.3211	223.3872	(64)
									Total per year (kWh/year) = Sum(64)m =			2296.0606	(64)
12Total per year (kWh/year)												2296	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	108.7603	96.6654	103.6745	93.2288	91.8418	84.3326	84.2580	86.6421	86.5521	94.6502	98.4044	107.8221	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	106.2159	117.5961	106.2159	109.7564	106.2159	109.7564	106.2159	106.2159	109.7564	106.2159	109.7564	106.2159	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	202.0564	204.1531	198.8695	187.6212	173.4223	160.0773	151.1621	149.0653	154.3490	165.5973	179.7962	193.1411	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)

Water heating gains (Table 5)

	146.1832	143.8473	139.3474	129.4845	123.4433	117.1286	113.2501	116.4544	120.2112	127.2180	136.6727	144.9222	(72)

Total internal gains

	514.8817	526.0228	504.8589	487.2883	463.5076	444.3885	428.0542	429.1618	441.7428	459.4573	486.6515	504.7054	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.1900	19.6403	0.6300	0.7000	0.7700	43.1567	(76)
West	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(80)

Solar gains	69.5669	136.0876	224.1169	326.8611	400.5806	410.0655	390.3991	335.3470	260.6572	161.4794	86.7417	57.2084	(83)
Total gains	584.4486	662.1104	728.9758	814.1494	864.0882	854.4540	818.4532	764.5088	702.4000	620.9367	573.3932	561.9138	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.0988	21.1470	21.1945	21.4204	21.4632	21.6647	21.6647	21.7024	21.5866	21.4632	21.3768	21.2872	
alpha	2.4066	2.4098	2.4130	2.4280	2.4309	2.4443	2.4443	2.4468	2.4391	2.4309	2.4251	2.4191	
util living area	0.9504	0.9321	0.9014	0.8377	0.7412	0.6064	0.4801	0.5218	0.7083	0.8661	0.9313	0.9546	(86)
MIT	18.1183	18.4280	18.9377	19.6323	20.2388	20.6802	20.8709	20.8376	20.4989	19.7096	18.8101	18.0728	(87)
Th 2	19.7315	19.7340	19.7365	19.7480	19.7502	19.7603	19.7603	19.7621	19.7564	19.7502	19.7458	19.7412	(88)
util rest of house	0.9421	0.9208	0.8843	0.8081	0.6907	0.5237	0.3658	0.4081	0.6350	0.8352	0.9179	0.9469	(89)
MIT 2	16.4317	16.8220	17.4615	18.3214	19.0386	19.5238	19.6956	19.6746	19.3502	18.4369	17.3170	16.3795	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	17.2546	17.6056	18.1818	18.9610	19.6242	20.0880	20.2691	20.2420	19.9107	19.0579	18.0455	17.2057	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2546	17.6056	18.1818	18.9610	19.6242	20.0880	20.2691	20.2420	19.9107	19.0579	18.0455	17.2057	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9193	0.8951	0.8573	0.7859	0.6850	0.5472	0.4151	0.4549	0.6452	0.8141	0.8934	0.9251	(94)
Useful gains	537.2741	592.6691	624.9872	639.8614	591.8610	467.5888	339.7802	347.7892	453.1967	505.4755	512.2410	519.8536	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1345.8057	1316.9302	1208.0925	1029.5074	809.2398	555.2397	371.2110	388.0339	590.0076	863.7403	1122.3023	1339.1592	(97)
Space heating kWh	601.5476	486.7034	433.8304	280.5450	161.7298	0.0000	0.0000	0.0000	0.0000	266.5490	439.2442	609.5634	(98a)
Space heating requirement - total per year (kWh/year)												3279.7128	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	601.5476	486.7034	433.8304	280.5450	161.7298	0.0000	0.0000	0.0000	0.0000	266.5490	439.2442	609.5634	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3279.7128	
Space heating per m2											(98c) / (4) =	45.5136	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	601.5476	486.7034	433.8304	280.5450	161.7298	0.0000	0.0000	0.0000	0.0000	266.5490	439.2442	609.5634	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	651.7308	527.3060	470.0221	303.9491	175.2219	0.0000	0.0000	0.0000	0.0000	288.7855	475.8875	660.4154	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	225.6782	199.6567	212.5005	187.9969	182.9739	165.6928	164.2200	170.3482	171.7607	190.5245	201.3211	223.3872	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1493	85.9792	85.6250	84.9556	83.7841	79.8000	79.8000	79.8000	79.8000	84.8128	85.7602	86.1929	(217)
Fuel for water heating, kWh/month	261.9616	232.2150	248.1758	221.2885	218.3872	207.6351	205.7894	213.4689	215.2390	224.6411	234.7489	259.1711	(219)

Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.0696	17.7050	15.9414	11.6794	9.0215	7.3706	8.2297	10.6973	13.8947	18.2306	20.5914	22.6829	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.8005	-47.6972	-68.6295	-77.2541	-83.3916	-77.8811	-76.9304	-72.5904	-64.9324	-54.5934	-37.1803	-29.2182	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.9545	-39.8933	-79.3237	-119.1826	-157.6255	-158.3796	-156.5040	-132.4844	-97.0795	-57.0519	-25.3085	-14.9863	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3553.3184	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2742.7219	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	178.1140	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1780.8730	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4779.2812	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3553.3184	0.2100	746.1969	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2742.7219	0.2100	575.9716	(264)
Space and water heating			1322.1684	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	178.1140	0.1443	25.7074	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-724.0993	0.1346	-97.4348	
PV Unit electricity exported	-1056.7738	0.1259	-133.0341	
Total			-230.4689	(269)
Total CO2, kg/year			1129.3362	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			15.6700	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3553.3184	1.1300	4015.2497	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2742.7219	1.1300	3099.2757	(278)
Space and water heating			7114.5254	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	178.1140	1.5338	273.1972	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-724.0993	1.4973	-1084.2006	
PV Unit electricity exported	-1056.7738	0.4621	-488.3263	
Total			-1572.5269	(283)
Total Primary energy kWh/year			5945.2965	(286)
Target Primary Energy Rate (TPER)			82.5000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		5.1500 (1b)	x	2.4000 (2b)	=	12.3600	(1b) - (3b)
First floor		66.9100 (1c)	x	2.6000 (2c)	=	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.3260	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1610	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3610	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3069	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3912	0.3836	0.3759	0.3375	0.3299	0.2915	0.2915	0.2838	0.3069	0.3299	0.3452	0.3606	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5765	0.5736	0.5707	0.5570	0.5544	0.5425	0.5425	0.5403	0.5471	0.5544	0.5596	0.5650	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7890.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		109.5025 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12 Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0450	0.4050
E4 Jamb	29.4000	0.0510	1.4994
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0570	1.1400
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.9845 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.4498	35.2670	35.0879	34.2466	34.0892	33.3564	33.3564	33.2207	33.6387	34.0892	34.4076	34.7405	(38)
Heat transfer coeff	100.2185	100.0358	99.8567	99.0153	98.8579	98.1252	98.1252	97.9895	98.4074	98.8579	99.1764	99.5093	(39)
Average = Sum(39)m / 12 =												99.0146	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3908	1.3882	1.3857	1.3741	1.3719	1.3617	1.3617	1.3598	1.3656	1.3719	1.3763	1.3809	(40)
HLP (average)												1.3741	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2951 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day)		59.7807 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.2204	63.4315	61.4783	59.0471	56.8783	54.6244	54.1560	56.1052	58.1044	60.4190	62.8717	65.1289	(44)
Energy conte	103.2932	90.3256	94.4899	80.8326	76.5692	67.1671	65.4970	69.4699	71.6485	81.9880	89.5723	101.9761	(45)
Energy content (annual)										Total = Sum(45)m =		992.8294	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	87.7993	76.7768	80.3164	68.7077	65.0838	57.0920	55.6724	59.0495	60.9012	69.6898	76.1364	86.6797	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	87.7993	76.7768	80.3164	68.7077	65.0838	57.0920	55.6724	59.0495	60.9012	69.6898	76.1364	86.6797	(64)
										Total per year (kWh/year) = Sum(64)m =		843.9050	(64)
12Total per year (kWh/year)												844	(64)
Electric shower(s)													
	50.2127	44.7400	48.8543	46.6211	47.4959	45.3065	46.8167	47.4959	46.6211	48.8543	47.9357	50.2127	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						571.1669	(64a)
Heat gains from water heating, kWh/month													
	34.5030	30.3792	32.2927	28.8322	28.1449	25.5996	25.6223	26.6363	26.8806	29.6360	31.0180	34.2231	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	103.0417	114.0819	103.0417	106.4764	103.0417	106.4764	103.0417	103.0417	106.4764	103.0417	106.4764	103.0417	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	202.0564	204.1531	198.8695	187.6212	173.4223	160.0773	151.1621	149.0653	154.3490	165.5973	179.7962	193.1411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)													
	46.3750	45.2071	43.4041	40.0447	37.8292	35.5550	34.4386	35.8015	37.3341	39.8334	43.0806	45.9988	(72)
Total internal gains													
	408.8993	420.8683	402.7415	391.5685	371.7194	359.5350	346.0685	345.3348	355.5858	365.8985	386.7794	399.6078	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	19.6403	0.3900	0.0000	0.7700	58.2130	(76)
West	6.0400	19.6403	0.3900	0.0000	0.7700	35.6237	(80)

Solar gains	93.8367	183.5645	302.3046	440.8933	540.3313	553.1252	526.5978	452.3397	351.5928	217.8148	117.0034	77.1668	(83)
Total gains	502.7360	604.4329	705.0462	832.4618	912.0507	912.6602	872.6663	797.6745	707.1786	583.7133	503.7828	476.7746	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.8710	21.9109	21.9502	22.1367	22.1720	22.3375	22.3375	22.3685	22.2735	22.1720	22.1008	22.0268	
alpha	2.4581	2.4607	2.4633	2.4758	2.4781	2.4892	2.4892	2.4912	2.4849	2.4781	2.4734	2.4685	
util living area													
	0.9630	0.9420	0.9050	0.8274	0.7153	0.5719	0.4473	0.4964	0.6984	0.8765	0.9457	0.9673	(86)
MIT	18.0487	18.4147	18.9876	19.7300	20.3338	20.7346	20.8964	20.8629	20.5372	19.7111	18.7519	17.9874	(87)
Th 2	19.7704	19.7724	19.7743	19.7833	19.7850	19.7928	19.7928	19.7943	19.7898	19.7850	19.7815	19.7780	(88)
util rest of house													
	0.9567	0.9323	0.8886	0.7973	0.6641	0.4918	0.3405	0.3881	0.6260	0.8478	0.9349	0.9617	(89)
MIT 2	17.1170	17.4774	18.0374	18.7511	19.3019	19.6409	19.7524	19.7366	19.4967	18.7540	17.8210	17.0614	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	17.5716	17.9348	18.5010	19.2287	19.8054	20.1746	20.3106	20.2861	20.0044	19.2210	18.2752	17.5132	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5716	17.9348	18.5010	19.2287	19.8054	20.1746	20.3106	20.2861	20.0044	19.2210	18.2752	17.5132	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9411	0.9130	0.8674	0.7813	0.6651	0.5187	0.3883	0.4346	0.6402	0.8315	0.9170	0.9471	(94)
Useful gains	473.1001	551.8690	611.5902	650.4038	606.5677	473.3770	338.8181	346.6773	452.7296	485.3431	461.9909	451.5564	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1330.0630	1303.9429	1198.3800	1022.6993	801.2861	547.0041	364.1018	380.7995	581.0357	852.2512	1108.3186	1324.7876	(97)
Space heating kWh													
	637.5804	505.3937	436.5716	268.0527	144.8704	0.0000	0.0000	0.0000	0.0000	272.9797	465.3559	649.6840	(98a)
Space heating requirement - total per year (kWh/year)												3380.4885	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	637.5804	505.3937	436.5716	268.0527	144.8704	0.0000	0.0000	0.0000	0.0000	272.9797	465.3559	649.6840	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3380.4885	
Space heating per m2											(98c) / (4) =	46.9121	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

	0.0000	0.0000	0.0000	0.0000	0.0000	922.3765	726.1262	744.7199	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7506	0.8113	0.7763	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	692.3398	589.1321	578.1316	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1026.9693	982.2664	896.6258	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	240.9333	292.4920	236.9597	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	60.2333	73.1230	59.2399	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												192.5962	(107)
Energy for space heating												46.9121	(99)
Energy for space cooling												2.6727	(108)
Total												49.5849	(109)
Fabric Energy Efficiency (DFEE)												49.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

			Area		Storey height		Volume	
Main dwelling			(m2)		(m)		(m3)	
Ground floor			5.1500 (1b)	x	2.4000 (2b)	=	12.3600	(1b) - (3b)
First floor			66.9100 (1c)	x	2.6000 (2c)	=	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)		72.0600						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.3260	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			3 * 10 =	30.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			30.0000 / (5) =	0.1610	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				5.0000	(17)
Infiltration rate				0.4110	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.3494	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4454	0.4367	0.4280	0.3843	0.3756	0.3319	0.3319	0.3232	0.3494	0.3756	0.3930	0.4105	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5992	0.5954	0.5916	0.5738	0.5705	0.5551	0.5551	0.5522	0.5610	0.5705	0.5772	0.5843	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Semi-glazed door			6.4300	1.0000	6.4300			(26a)
TER Opening Type			11.5900	1.1450	13.2710			(27)
Heatloss Floor 1			5.1600	0.1300	0.6708			(28a)
Exposed floor			61.4500	0.1300	7.9885			(28b)
External Wall 1	90.4400	18.0200	72.4200	0.1800	13.0356			(29a)
Sheltered wall	27.3000		27.3000	0.1800	4.9140			(29a)
External Roof 1	66.9100		66.9100	0.1100	7.3601			(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.6700			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							109.5025	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	22.2000	0.0600	1.3320
E12 Gable (insulation at ceiling level)	12.0000	0.0600	0.7200
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0500	0.4500
E4 Jamb	29.4000	0.0500	1.4700
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0900	1.8000
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.3725	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	67.0425	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.8436	36.6067	36.3746	35.2841	35.0800	34.1302	34.1302	33.9543	34.4961	35.0800	35.4928	35.9243	(38)
Heat transfer coeff	103.8861	103.6492	103.4171	102.3265	102.1225	101.1727	101.1727	100.9968	101.5386	102.1225	102.5353	102.9668	(39)
Average = Sum(39)m / 12 =												102.3256	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.4417	1.4384	1.4352	1.4200	1.4172	1.4040	1.4040	1.4016	1.4091	1.4172	1.4229	1.4289	(40)
HLP (average)												1.4200	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2951 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day) 59.7807 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.2204	63.4315	61.4783	59.0471	56.8783	54.6244	54.1560	56.1052	58.1044	60.4190	62.8717	65.1289	(44)
Energy conte	103.2932	90.3256	94.4899	80.8326	76.5692	67.1671	65.4970	69.4699	71.6485	81.9880	89.5723	101.9761	(45)
Energy content (annual)										Total = Sum(45)m =		992.8294	

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

87.7993	76.7768	80.3164	68.7077	65.0838	57.0920	55.6724	59.0495	60.9012	69.6898	76.1364	86.6797	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

87.7993	76.7768	80.3164	68.7077	65.0838	57.0920	55.6724	59.0495	60.9012	69.6898	76.1364	86.6797	(64)
								Total per year (kWh/year) = Sum(64)m =			843.9050	(64)
12Total per year (kWh/year)											844	(64)

Electric shower(s)

50.2127	44.7400	48.8543	46.6211	47.4959	45.3065	46.8167	47.4959	46.6211	48.8543	47.9357	50.2127	(64a)
				Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							571.1669	(64a)

Heat gains from water heating, kWh/month

34.5030	30.3792	32.2927	28.8322	28.1449	25.5996	25.6223	26.6363	26.8806	29.6360	31.0180	34.2231	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	114.7540	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	106.2159	117.5961	106.2159	109.7564	106.2159	109.7564	106.2159	106.2159	109.7564	106.2159	109.7564	106.2159	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.0564	204.1531	198.8695	187.6212	173.4223	160.0773	151.1621	149.0653	154.3490	165.5973	179.7962	193.1411	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	34.4754	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)	46.3750	45.2071	43.4041	40.0447	37.8292	35.5550	34.4386	35.8015	37.3341	39.8334	43.0806	45.9988	(72)
Total internal gains	412.0735	424.3826	405.9157	394.8485	374.8936	362.8150	349.2427	348.5089	358.8657	369.0727	390.0594	402.7820	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.1900	19.6403	0.6300	0.7000	0.7700	43.1567	(76)
West	4.4000	19.6403	0.6300	0.7000	0.7700	26.4102	(80)

Solar gains 69.5669	136.0876	224.1169	326.8611	400.5806	410.0655	390.3991	335.3470	260.6572	161.4794	86.7417	57.2084	(83)
Total gains 481.6404	560.4702	630.0326	721.7096	775.4741	772.8804	739.6417	683.8560	619.5229	530.5521	476.8011	459.9904	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	21.0988	21.1470	21.1945	21.4204	21.4632	21.6647	21.6647	21.7024	21.5866	21.4632	21.3768	21.2872	
alpha	2.4066	2.4098	2.4130	2.4280	2.4309	2.4443	2.4443	2.4468	2.4391	2.4309	2.4251	2.4191	
util living area	0.9665	0.9509	0.9245	0.8665	0.7763	0.6446	0.5180	0.5645	0.7514	0.8980	0.9521	0.9699	(86)
MIT	17.8985	18.2222	18.7550	19.4931	20.1441	20.6311	20.8467	20.8057	20.4200	19.5585	18.6135	17.8515	(87)
Th 2	19.7315	19.7340	19.7365	19.7480	19.7502	19.7603	19.7603	19.7621	19.7564	19.7502	19.7458	19.7412	(88)

util rest of house	0.9606	0.9423	0.9107	0.8406	0.7289	0.5621	0.3988	0.4470	0.6819	0.8725	0.9422	0.9646	(89)
MIT 2	16.9451	17.2653	17.7900	18.5100	19.1180	19.5437	19.6991	19.6784	19.3816	18.5896	17.6637	16.9046	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	17.4103	17.7322	18.2608	18.9897	19.6187	20.0743	20.2591	20.2284	19.8883	19.0624	18.1271	17.3666	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.4103	17.7322	18.2608	18.9897	19.6187	20.0743	20.2591	20.2284	19.8883	19.0624	18.1271	17.3666	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9454	0.9239	0.8898	0.8215	0.7232	0.5849	0.4498	0.4946	0.6903	0.8549	0.9249	0.9504	(94)
Useful gains	455.3662	517.8191	560.5732	592.9073	560.8443	452.0252	332.6798	338.2383	427.6698	453.5469	440.9714	437.1832	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1361.9739	1330.0464	1216.2700	1032.4429	808.6752	553.8462	370.1973	386.6599	587.7320	864.1983	1130.6711	1355.7261	(97)
Space heating kWh	674.5161	545.8168	487.8384	316.4657	184.3862	0.0000	0.0000	0.0000	0.0000	305.5247	496.5838	683.3959	(98a)
Space heating requirement - total per year (kWh/year)												3694.5276	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	674.5161	545.8168	487.8384	316.4657	184.3862	0.0000	0.0000	0.0000	0.0000	305.5247	496.5838	683.3959	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3694.5276	
Space heating per m2											(98c) / (4) =	51.2702	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	951.0236	748.6781	767.5759	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6732	0.7426	0.7065	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	640.2235	555.9525	542.2743	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	860.0343	823.3732	760.2712	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	158.2638	198.9610	162.1897	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	39.5659	49.7403	40.5474	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												129.8536	(107)
Energy for space heating												51.2702	(99)
Energy for space cooling												1.8020	(108)
Total												53.0722	(109)
Fabric Energy Efficiency (TFEE)												53.1	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500	(1b)	x 2.4000	(2b) =	12.3600	(1b) - (3b)
First floor	66.9100	(1c)	x 2.6000	(2c) =	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		186.3260	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7890.7500 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.5025 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12 Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0450	0.4050
E4 Jamb	29.4000	0.0510	1.4994
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0570	1.1400
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.9845 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	(38)
Heat transfer coeff	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	(39)

Average = Sum(39)m / 12 = 95.5125

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	(40)
HLP (average)												1.3255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2951 (42)

Hot water usage for mixer showers

62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day) 117.5885 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893	(44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739	(45)
Energy content (annual)											Total = Sum(45)m =	1953.1211	
Distribution loss (46)m = 0.15 x (45)m	30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss

Combi loss

Total heat required for water heating calculated for each month

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS

PV diverter

Solar input

FGHRS

Output from w/h

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)

Total per year (kWh/year) = Sum(64)m = 2489.1601 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

103.7843	92.1710	98.6985	88.4133	86.8658	79.5171	79.2820	81.6661	81.7366	89.6742	93.5889	102.8461	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	29.4664	26.1718	21.2844	16.1136	12.0451	10.1690	10.9880	14.2826	19.1701	24.3408	28.4093	30.2854	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.5767	304.7062	296.8201	280.0317	258.8392	238.9214	225.6150	222.4856	230.3716	247.1601	268.3525	288.2704	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)

Water heating gains (Table 5)

	139.4951	137.1592	132.6592	122.7963	116.7551	110.4404	106.5619	109.7662	113.5231	120.5298	129.9846	138.2340	(72)

Total internal gains

	567.5054	565.0043	547.7309	515.9088	484.6066	456.4980	440.1320	443.5015	460.0319	488.9979	523.7135	553.7570	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	19.6403	0.3900	0.0000	0.7700	58.2130	(76)
West	6.0400	19.6403	0.3900	0.0000	0.7700	35.6237	(80)

Solar gains	93.8367	183.5645	302.3046	440.8933	540.3313	553.1252	526.5978	452.3397	351.5928	217.8148	117.0034	77.1668	(83)
Total gains	661.3421	748.5689	850.0355	956.8021	1024.9379	1009.6232	966.7298	895.8412	811.6247	706.8126	640.7169	630.9237	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	
alpha	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	
util living area													
	0.9339	0.9099	0.8632	0.7807	0.6638	0.5246	0.4032	0.4456	0.6388	0.8256	0.9113	0.9406	(86)
Living	18.5259	18.8315	19.3518	19.9653	20.4737	20.7933	20.9228	20.8983	20.6443	19.9627	19.1174	18.4404	
Non living	16.9900	17.3709	18.0142	18.7541	19.3374	19.6709	19.7827	19.7668	19.5377	18.7749	17.7379	16.8833	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7343	18.8315	19.3518	19.9653	20.4737	20.7933	20.9228	20.8983	20.6443	19.9627	19.1174	18.7985	(87)
Th 2	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	(88)
util rest of house													
	0.9237	0.8962	0.8424	0.7469	0.6115	0.4482	0.3060	0.3461	0.5658	0.7904	0.8954	0.9313	(89)
MIT 2	18.6924	17.3709	18.0142	18.7541	19.3374	19.6709	19.7827	19.7668	19.5377	18.7749	17.7379	17.4126	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.2008	18.0836	18.6668	19.3451	19.8918	20.2185	20.3390	20.3189	20.0776	19.3544	18.4110	18.0888	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2008	18.0836	18.6668	19.3451	19.8918	20.2185	20.3390	20.3189	20.0776	19.3544	18.4110	18.0888	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9175	0.8706	0.8179	0.7315	0.6149	0.4751	0.3501	0.3898	0.5830	0.7740	0.8711	0.9137	(94)
Useful gains	606.7632	651.6766	695.2131	699.9180	630.2399	479.7127	338.4341	349.1960	473.1534	547.0842	558.1262	576.4955	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.2094	1259.1987	1162.0851	997.6379	782.4188	536.6415	357.1200	374.3068	570.9385	836.1574	1080.3437	1326.5561	(97)
Space heating kWh													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98a)
Space heating requirement - total per year (kWh/year)												2839.7353	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2839.7353	
Space heating per m2											(98c) / (4) =	39.4079	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	262.4951	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98)
Space heating efficiency (main heating system 1)													
	262.4951	262.4951	262.4951	262.4951	262.4951	0.0000	0.0000	0.0000	0.0000	262.4951	262.4951	262.4951	(210)
Space heating fuel (main heating system)													
	231.4085	155.5286	132.3273	81.6618	43.1327	0.0000	0.0000	0.0000	0.0000	81.9331	143.2395	212.5926	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement													
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)
Efficiency of water heater												183.4483	(216)
(217)m	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	(217)
Fuel for water heating, kWh/month													
	135.2546	119.5920	126.9166	111.1804	107.5177	96.5956	95.0846	98.9931	100.2343	112.1219	119.6654	133.7164	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.1513	1.9431	2.1513	2.0819	2.1513	2.0819	2.1513	2.1513	2.0819	2.1513	2.0819	2.1513	(231)
Lighting	25.7918	20.6911	18.6301	13.6492	10.5430	8.6137	9.6177	12.5015	16.2382	21.3053	24.0643	26.5086	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.6510	-17.8867	-31.0262	-40.9989	-48.7248	-46.0048	-45.1389	-39.9256	-31.4449	-22.3501	-12.4738	-8.8036	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.6953	-4.4243	-11.0577	-20.5877	-31.3168	-34.1760	-33.3638	-26.1279	-16.6288	-7.3259	-2.5184	-1.2874	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	1081.8242	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.4483	
Water heating fuel used	1356.8727	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 2.3400, total flow = 21.0000, SFP = 0.1114)		
mechanical ventilation fans (SFP = 0.1114)	25.3297	(230a)
Total electricity for the above, kWh/year	25.3297	(231)
Electricity for lighting (calculated in Appendix L)	208.1547	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-545.9391	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2126.2421	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	865.4593	17.5600	169.6300	(240)
Space heating - main system 1 (low-rate cost)	216.3648	0.0940	20.3383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	949.8109	19.6000	186.1629	(245)
Low-rate cost	407.0618	9.4000	38.2638	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	25.3297	18.5800	4.2154	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	208.1547	18.5800	38.6751	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.4292	18.5800	-66.0387	
PV Unit electricity exported	-190.5099	5.5900	-10.6495	
Total			-76.6883	(252)
Total energy cost			387.5973	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	1.1920	(257)
SAP value	80.6777	
SAP rating (Section 12)	81	(258)
SAP band	B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	865.4593	0.1626	140.7260	(261)
Space heating - main system 1 (low-rate cost)	216.3648	0.1365	29.5348	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	949.8109	0.1479	140.4793	(264)
Water heating - low rate cost	407.0618	0.1241	50.5290	(264)
Space and water heating			361.2691	(265)
Pumps, fans and electric keep-hot	25.3297	0.1432	3.5147	(267)
Energy for lighting	208.1547	0.1490	31.0192	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.4292	0.1360	-48.3453	
PV Unit electricity exported	-190.5099	0.1204	-22.9392	
Total			-71.2845	(269)
Total CO2, kg/year			324.5185	(272)
CO2 emissions per m2			4.5000	(273)
EI value			96.2852	
EI rating			96	(274)

EI band A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500	(1b)	x 2.4000	(2b) =	12.3600	(1b) - (3b)
First floor	66.9100	(1c)	x 2.6000	(2c) =	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		186.3260	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	7890.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		109.5025 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12 Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0450	0.4050
E4 Jamb	29.4000	0.0510	1.4994
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0570	1.1400
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.9845 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	(38)
Heat transfer coeff	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	(39)
Average = Sum(39)m / 12 =												95.5125	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	(40)
HLP (average)												1.3255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2951	(42)
Hot water usage for mixer showers													
	62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604	(42a)
Hot water usage for baths													
	27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)
Hot water usage for other uses													
	38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)
Average daily hot water use (litres/day)												117.5885	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893	(44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739	(45)
Energy content (annual)										Total = Sum(45)m =		1953.1211	
Distribution loss (46)m = 0.15 x (45)m													
	30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)
										Total per year (kWh/year) = Sum(64)m =		2489.1601	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7843	92.1710	98.6985	88.4133	86.8658	79.5171	79.2820	81.6661	81.7366	89.6742	93.5889	102.8461	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.4664	26.1718	21.2844	16.1136	12.0451	10.1690	10.9880	14.2826	19.1701	24.3408	28.4093	30.2854	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.5767	304.7062	296.8201	280.0317	258.8392	238.9214	225.6150	222.4856	230.3716	247.1601	268.3525	288.2704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)													
	139.4951	137.1592	132.6592	122.7963	116.7551	110.4404	106.5619	109.7662	113.5231	120.5298	129.9846	138.2340	(72)
Total internal gains													
	567.5054	565.0043	547.7309	515.9088	484.6066	456.4980	440.1320	443.5015	460.0319	488.9979	523.7135	553.7570	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	26.6540	0.3900	0.0000	0.7700	79.0015	(76)
West	6.0400	26.6540	0.3900	0.0000	0.7700	48.3454	(80)

Solar gains	127.3469	210.1488	340.6872	507.4732	598.5596	654.7702	626.1517	540.6932	424.4877	265.7562	152.9504	104.4204	(83)
Total gains	694.8523	775.1531	888.4180	1023.3820	1083.1662	1111.2682	1066.2837	984.1947	884.5196	754.7541	676.6639	658.1774	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	
alpha	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	
util living area													
	0.9179	0.8943	0.8363	0.7293	0.5841	0.4127	0.2859	0.3078	0.5309	0.7616	0.8810	0.9242	(86)
Living	18.8187	19.0557	19.5926	20.2055	20.6672	20.9037	20.9739	20.9690	20.8106	20.2791	19.4868	18.7923	
Non living	17.3583	17.6507	18.3082	19.0321	19.5415	19.7641	19.8129	19.8113	19.6938	19.1425	18.1960	17.3273	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8841	19.0557	19.5926	20.2055	20.6672	20.9037	20.9739	20.9690	20.8106	20.2791	19.4868	19.1011	(87)
Th 2	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	(88)

util rest of house													
	0.9049	0.8780	0.8111	0.6886	0.5220	0.3298	0.1877	0.2028	0.4439	0.7130	0.8587	0.9118	(89)
MIT 2	18.8392	17.6507	18.3082	19.0321	19.5415	19.7641	19.8129	19.8113	19.6938	19.1425	18.1960	17.7767	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.3490	18.3362	18.9349	19.6046	20.0908	20.3202	20.3794	20.3762	20.2388	19.6971	18.8258	18.4229	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3490	18.3362	18.9349	19.6046	20.0908	20.3202	20.3794	20.3762	20.2388	19.6971	18.8258	18.4229	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8989	0.8524	0.7889	0.6804	0.5370	0.3660	0.2350	0.2533	0.4764	0.7072	0.8354	0.8933	(94)
Useful gains	624.5788	660.7090	700.8823	696.3159	581.6765	406.6977	250.6231	249.3087	421.3680	533.7799	565.3186	587.9460	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1341.8581	1206.9165	1101.7246	926.9133	677.2564	431.7316	255.9169	255.6104	471.7128	735.1709	986.2454	1234.3018	(97)
Space heating kWh													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98a)
Space heating requirement - total per year (kWh/year)												2369.8663	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2369.8663	
Space heating per m2											(98c) / (4) =	32.8874	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												262.4951	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98)
Space heating efficiency (main heating system 1)													
	262.4951	262.4951	262.4951	262.4951	262.4951	0.0000	0.0000	0.0000	0.0000	262.4951	262.4951	262.4951	(210)
Space heating fuel (main heating system)													
	203.3013	139.8317	113.6123	63.2507	27.0906	0.0000	0.0000	0.0000	0.0000	57.0810	115.4564	183.1991	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)
Efficiency of water heater												183.4483	(216)
(217)m	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	(217)
Fuel for water heating, kWh/month													
	135.2546	119.5920	126.9166	111.1804	107.5177	96.5956	95.0846	98.9931	100.2343	112.1219	119.6654	133.7164	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.1513	1.9431	2.1513	2.0819	2.1513	2.0819	2.1513	2.1513	2.0819	2.1513	2.0819	2.1513	(231)
Lighting	25.7918	20.6911	18.6301	13.6492	10.5430	8.6137	9.6177	12.5015	16.2382	21.3053	24.0643	26.5086	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-14.1379	-20.2247	-34.3422	-45.6445	-52.2595	-52.0248	-51.2235	-45.7284	-36.5960	-26.3936	-15.8852	-11.6741	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.7378	-5.5178	-13.4756	-25.7965	-37.0167	-43.4824	-42.7297	-33.8169	-21.9193	-10.1066	-3.8584	-2.0758	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												902.8231	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.4483	
Water heating fuel used												1356.8727	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 2.3400, total flow = 21.0000, SFP = 0.1114)													
mechanical ventilation fans (SFP = 0.1114)												25.3297	(230a)
Total electricity for the above, kWh/year												25.3297	(231)
Electricity for lighting (calculated in Appendix L)												208.1547	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-648.6681	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1844.5121	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	722.2585	27.8600	225.3446	(240)
Space heating - main system 1 (low-rate cost)	180.5646	0.1450	26.1819	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	949.8109	31.2000	296.3410	(245)
Low-rate cost	407.0618	14.5000	59.0240	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	25.3297	29.5300	6.6761	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	208.1547	29.5300	61.4681	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	29.5300	-119.9315	
PV Unit electricity exported	-242.5336	5.8100	-14.0912	
Total			-134.0227	(252)
Total energy cost			544.0130	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	722.2585	0.1634	118.0045	(261)
Space heating - main system 1 (low-rate cost)	180.5646	0.1372	24.7648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	949.8109	0.1479	140.4793	(264)
Water heating - low rate cost	407.0618	0.1241	50.5290	(264)
Space and water heating			333.7776	(265)
Pumps, fans and electric keep-hot	25.3297	0.1432	3.5147	(267)
Energy for lighting	208.1547	0.1490	31.0192	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	0.1363	-55.3548	
PV Unit electricity exported	-242.5336	0.1205	-29.2173	
Total			-84.5721	(269)
Total CO2, kg/year			283.7394	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	722.2585	1.2872	1162.1377	(275)
Space heating - main system 1 (low-rate cost)	180.5646	1.4965	270.2092	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	949.8109	1.5529	1474.9254	(278)
Water heating - low rate cost	407.0618	1.4442	587.8840	(278)
Space and water heating			3495.1564	(279)
Pumps, fans and electric keep-hot	25.3297	1.5335	38.3227	(281)
Energy for lighting	208.1547	1.5547	323.6274	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	1.5083	-612.5571	
PV Unit electricity exported	-242.5336	0.4418	-107.1500	
Total			-719.7070	(283)
Total Primary energy kWh/year			3137.3994	(286)

SAP 10 EPC IMPROVEMENTS

2B3P FOG ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating Not applicable
U Solar photovoltaic panels Not applicable
V2 Wind turbine Not applicable

Recommended measures: SAP change Cost change CO2 change
(none)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

Potential energy efficiency rating: B 81
Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£678	£678	£0
Space heating	£261	£261	£0
Water heating	£355	£355	£0
Lighting	£61	£61	£0
Generated (PV)	-£134	-£134	£0
Total cost of fuels	£544	£544	£0
Total cost of uses	£543	£543	£0
Delivered energy	26 kWh/m²	26 kWh/m²	0 kWh/m²

Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	44 kWh/m²	44 kWh/m²	0 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500	(1b) x	2.4000	(2b) =	12.3600	(1b) - (3b)
First floor	66.9100	(1c) x	2.6000	(2c) =	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		186.3260	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		7890.7500	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							109.5025	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12 Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0450	0.4050
E4 Jamb	29.4000	0.0510	1.4994
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0570	1.1400
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.9845 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	(38)

Heat transfer coeff

	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	(39)
Average = Sum(39)m / 12 =											95.5125	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	(40)
HLP (average)												1.3255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2951 (42)
Hot water usage for mixer showers												
	62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604 (42a)
Hot water usage for baths												
	27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950 (42b)
Hot water usage for other uses												
	38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339 (42c)
Average daily hot water use (litres/day)												117.5885 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												
	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893 (44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739 (45)
Energy content (annual)										Total = Sum(45)m =		1953.1211	
Distribution loss (46)m = 0.15 x (45)m												
	30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7182 (55)
Total storage loss												
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642 (56)
If cylinder contains dedicated solar storage												
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005 (64)
										Total per year (kWh/year) = Sum(64)m =		2489.1601 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month												
	103.7843	92.1710	98.6985	88.4133	86.8658	79.5171	79.2820	81.6661	81.7366	89.6742	93.5889	102.8461 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	29.4664	26.1718	21.2844	16.1136	12.0451	10.1690	10.9880	14.2826	19.1701	24.3408	28.4093	30.2854 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	301.5767	304.7062	296.8201	280.0317	258.8392	238.9214	225.6150	222.4856	230.3716	247.1601	268.3525	288.2704 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)												
	139.4951	137.1592	132.6592	122.7963	116.7551	110.4404	106.5619	109.7662	113.5231	120.5298	129.9846	138.2340	(72)
Total internal gains												
	567.5054	565.0043	547.7309	515.9088	484.6066	456.4980	440.1320	443.5015	460.0319	488.9979	523.7135	553.7570	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	19.6403	0.3900	0.0000	0.7700	58.2130	(76)
West	6.0400	19.6403	0.3900	0.0000	0.7700	35.6237	(80)

Solar gains	93.8367	183.5645	302.3046	440.8933	540.3313	553.1252	526.5978	452.3397	351.5928	217.8148	117.0034	77.1668	(83)
Total gains	661.3421	748.5689	850.0355	956.8021	1024.9379	1009.6232	966.7298	895.8412	811.6247	706.8126	640.7169	630.9237	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	
alpha	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	
util living area													
	0.9339	0.9099	0.8632	0.7807	0.6638	0.5246	0.4032	0.4456	0.6388	0.8256	0.9113	0.9406	(86)
Living	18.5259	18.8315	19.3518	19.9653	20.4737	20.7933	20.9228	20.8983	20.6443	19.9627	19.1174	18.4404	
Non living	16.9900	17.3709	18.0142	18.7541	19.3374	19.6709	19.7827	19.7668	19.5377	18.7749	17.7379	16.8833	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	

16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.7343	18.8315	19.3518	19.9653	20.4737	20.7933	20.9228	20.8983	20.6443	19.9627	19.1174	18.7985	(87)
Th 2	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	(88)
util rest of house													
	0.9237	0.8962	0.8424	0.7469	0.6115	0.4482	0.3060	0.3461	0.5658	0.7904	0.8954	0.9313	(89)
MIT 2	18.6924	17.3709	18.0142	18.7541	19.3374	19.6709	19.7827	19.7668	19.5377	18.7749	17.7379	17.4126	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.2008	18.0836	18.6668	19.3451	19.8918	20.2185	20.3390	20.3189	20.0776	19.3544	18.4110	18.0888	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2008	18.0836	18.6668	19.3451	19.8918	20.2185	20.3390	20.3189	20.0776	19.3544	18.4110	18.0888	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9175	0.8706	0.8179	0.7315	0.6149	0.4751	0.3501	0.3898	0.5830	0.7740	0.8711	0.9137	(94)
Useful gains	606.7632	651.6766	695.2131	699.9180	630.2399	479.7127	338.4341	349.1960	473.1534	547.0842	558.1262	576.4955	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1423.2094	1259.1987	1162.0851	997.6379	782.4188	536.6415	357.1200	374.3068	570.9385	836.1574	1080.3437	1326.5561	(97)
Space heating kWh													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98a)
Space heating requirement - total per year (kWh/year)												2839.7353	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2839.7353	
Space heating per m2											(98c) / (4) =	39.4079	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	262.4951 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	607.4360	408.2549	347.3528	214.3583	113.2211	0.0000	0.0000	0.0000	0.0000	215.0705	375.9966	558.0451	(98)
Space heating efficiency (main heating system 1)													
	262.4951	262.4951	262.4951	262.4951	262.4951	0.0000	0.0000	0.0000	0.0000	262.4951	262.4951	262.4951	(210)
Space heating fuel (main heating system)													
	231.4085	155.5286	132.3273	81.6618	43.1327	0.0000	0.0000	0.0000	0.0000	81.9331	143.2395	212.5926	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)
Efficiency of water heater												183.4483	(216)
(217)m	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	(217)
Fuel for water heating, kWh/month													
	135.2546	119.5920	126.9166	111.1804	107.5177	96.5956	95.0846	98.9931	100.2343	112.1219	119.6654	133.7164	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.1513	1.9431	2.1513	2.0819	2.1513	2.0819	2.1513	2.1513	2.0819	2.1513	2.0819	2.1513	(231)
Lighting	25.7918	20.6911	18.6301	13.6492	10.5430	8.6137	9.6177	12.5015	16.2382	21.3053	24.0643	26.5086	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.6510	-17.8867	-31.0262	-40.9989	-48.7248	-46.0048	-45.1389	-39.9256	-31.4449	-22.3501	-12.4738	-8.8036	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-1.6953	-4.4243	-11.0577	-20.5877	-31.3168	-34.1760	-33.3638	-26.1279	-16.6288	-7.3259	-2.5184	-1.2874	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	1081.8242 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	183.4483
Water heating fuel used	1356.8727 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 2.3400, total flow = 21.0000, SFP = 0.1114)	
mechanical ventilation fans (SFP = 0.1114)	25.3297 (230a)
Total electricity for the above, kWh/year	25.3297 (231)
Electricity for lighting (calculated in Appendix L)	208.1547 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-545.9391 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2126.2421 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	865.4593	17.5600	169.6300	(240)
Space heating - main system 1 (low-rate cost)	216.3648	0.0940	20.3383	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	949.8109	19.6000	186.1629	(245)
Low-rate cost	407.0618	9.4000	38.2638	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	25.3297	18.5800	4.2154	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	208.1547	18.5800	38.6751	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.4292	18.5800	-66.0387	
PV Unit electricity exported	-190.5099	5.5900	-10.6495	
Total			-76.6883	(252)
Total energy cost			387.5973	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1920 (257)
SAP value		80.6777
SAP rating (Section 12)		81 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	865.4593	0.1626	140.7260	(261)
Space heating - main system 1 (low-rate cost)	216.3648	0.1365	29.5348	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	949.8109	0.1479	140.4793	(264)
Water heating - low rate cost	407.0618	0.1241	50.5290	(264)
Space and water heating			361.2691	(265)
Pumps, fans and electric keep-hot	25.3297	0.1432	3.5147	(267)
Energy for lighting	208.1547	0.1490	31.0192	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-355.4292	0.1360	-48.3453	
PV Unit electricity exported	-190.5099	0.1204	-22.9392	
Total			-71.2845	(269)
Total CO2, kg/year			324.5185	(272)
CO2 emissions per m2			4.5000	(273)
EI value			96.2852	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	5.1500 (1b)	x	2.4000 (2b)	=	12.3600	(1b) - (3b)
First floor	66.9100 (1c)	x	2.6000 (2c)	=	173.9660	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.0600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	186.3260	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			6.4300	1.4000	9.0020			(26a)
Windows			15.9100	0.6998	11.1345			(27)
Heatloss Floor 1			5.1600	0.1100	0.5676	75.0000	387.0000	(28a)
Exposed floor			61.4500	0.1165	7.1592	0.0000	0.0000	(28b)
External Wall 1	90.4400	22.3400	68.1000	0.1800	12.2580	60.0000	4086.0000	(29a)
Sheltered wall	27.3000		27.3000	0.1700	4.6410	60.0000	1638.0000	(29a)
External Roof 1	66.9100		66.9100	0.0900	6.0219	9.0000	602.1900	(30)
Total net area of external elements Aum(A, m2)			251.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7842			(33)
Main dwelling								
Internal Wall 1			41.6800			9.0000	375.1200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			5.1600			9.0000	46.4400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 7890.7500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 109.5025 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	22.2000	0.0980	2.1756
E12 Gable (insulation at ceiling level)	12.0000	0.0970	1.1640
E1 Steel lintel with perforated steel base plate	9.9300	0.0500	0.4965
E3 Sill	9.0000	0.0450	0.4050
E4 Jamb	29.4000	0.0510	1.4994
E6 Intermediate floor within a dwelling	12.1000	0.0000	0.0000
E16 Corner (normal)	20.0000	0.0570	1.1400
E20 Exposed floor (normal)	22.2000	0.3200	7.1040

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.9845 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 64.7687 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	30.7438	(38)
Heat transfer coeff	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	95.5125	(39)
Average = Sum(39)m / 12 =												95.5125	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	1.3255	(40)
HLP (average)												1.3255	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2951 (42)
Hot water usage for mixer showers

62.7006	61.7583	60.3853	57.7581	55.8194	53.6573	52.4284	53.7911	55.2848	57.6062	60.2898	62.4604	(42a)

Hot water usage for baths

27.0865	26.6843	26.1178	25.0733	24.2912	23.4239	22.9555	23.5180	24.1305	25.0585	26.1245	26.9950	(42b)

Hot water usage for other uses

38.1339	36.7472	35.3605	33.9738	32.5872	31.2005	31.2005	32.5872	33.9738	35.3605	36.7472	38.1339	(42c)

Average daily hot water use (litres/day) 117.5885 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.9211	125.1898	121.8636	116.8053	112.6977	108.2817	106.5844	109.8963	113.3892	118.0253	123.1615	127.5893	(44)
Energy conte	202.5957	178.2686	187.2998	159.9006	151.7128	133.1450	128.9046	136.0745	139.8202	160.1592	175.4661	199.7739	(45)
Energy content (annual)											Total = Sum(45)m =	1953.1211	
Distribution loss (46)m = 0.15 x (45)m	30.3894	26.7403	28.0950	23.9851	22.7569	19.9718	19.3357	20.4112	20.9730	24.0239	26.3199	29.9661	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005	(64)

Total per year (kWh/year) = Sum(64)m = 2489.1601 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month

103.7843	92.1710	98.6985	88.4133	86.8658	79.5171	79.2820	81.6661	81.7366	89.6742	93.5889	102.8461	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	137.7048	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.4664	26.1718	21.2844	16.1136	12.0451	10.1690	10.9880	14.2826	19.1701	24.3408	28.4093	30.2854	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.5767	304.7062	296.8201	280.0317	258.8392	238.9214	225.6150	222.4856	230.3716	247.1601	268.3525	288.2704	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	51.0656	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	-91.8032	(71)
Water heating gains (Table 5)													
	139.4951	137.1592	132.6592	122.7963	116.7551	110.4404	106.5619	109.7662	113.5231	120.5298	129.9846	138.2340	(72)
Total internal gains													
	567.5054	565.0043	547.7309	515.9088	484.6066	456.4980	440.1320	443.5015	460.0319	488.9979	523.7135	553.7570	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8700	26.6540	0.3900	0.0000	0.7700	79.0015	(76)
West	6.0400	26.6540	0.3900	0.0000	0.7700	48.3454	(80)

Solar gains	127.3469	210.1488	340.6872	507.4732	598.5596	654.7702	626.1517	540.6932	424.4877	265.7562	152.9504	104.4204	(83)
Total gains	694.8523	775.1531	888.4180	1023.3820	1083.1662	1111.2682	1066.2837	984.1947	884.5196	754.7541	676.6639	658.1774	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	22.9486	
alpha	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	2.5299	
util living area													
	0.9179	0.8943	0.8363	0.7293	0.5841	0.4127	0.2859	0.3078	0.5309	0.7616	0.8810	0.9242	(86)
Living	18.8187	19.0557	19.5926	20.2055	20.6672	20.9037	20.9739	20.9690	20.8106	20.2791	19.4868	18.7923	
Non living	17.3583	17.6507	18.3082	19.0321	19.5415	19.7641	19.8129	19.8113	19.6938	19.1425	18.1960	17.3273	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.8841	19.0557	19.5926	20.2055	20.6672	20.9037	20.9739	20.9690	20.8106	20.2791	19.4868	19.1011	(87)
Th 2	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	19.8209	(88)
util rest of house													
	0.9049	0.8780	0.8111	0.6886	0.5220	0.3298	0.1877	0.2028	0.4439	0.7130	0.8587	0.9118	(89)
MIT 2	18.8392	17.6507	18.3082	19.0321	19.5415	19.7641	19.8129	19.8113	19.6938	19.1425	18.1960	17.7767	(90)
Living area fraction										fLA = Living area / (4) =		0.4879	(91)
MIT	19.3490	18.3362	18.9349	19.6046	20.0908	20.3202	20.3794	20.3762	20.2388	19.6971	18.8258	18.4229	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3490	18.3362	18.9349	19.6046	20.0908	20.3202	20.3794	20.3762	20.2388	19.6971	18.8258	18.4229	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8989	0.8524	0.7889	0.6804	0.5370	0.3660	0.2350	0.2533	0.4764	0.7072	0.8354	0.8933	(94)
Useful gains	624.5788	660.7090	700.8823	696.3159	581.6765	406.6977	250.6231	249.3087	421.3680	533.7799	565.3186	587.9460	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1341.8581	1206.9165	1101.7246	926.9133	677.2564	431.7316	255.9169	255.6104	471.7128	735.1709	986.2454	1234.3018	(97)
Space heating kWh													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98a)
Space heating requirement - total per year (kWh/year)												2369.8663	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2369.8663	
Space heating per m2											(98c) / (4) =	32.8874	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	262.4951	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	533.6558	367.0514	298.2266	166.0301	71.1114	0.0000	0.0000	0.0000	0.0000	149.8349	303.0673	480.8887	(98)
Space heating efficiency (main heating system 1)													
	262.4951	262.4951	262.4951	262.4951	262.4951	0.0000	0.0000	0.0000	0.0000	262.4951	262.4951	262.4951	(210)
Space heating fuel (main heating system)													
	203.3013	139.8317	113.6123	63.2507	27.0906	0.0000	0.0000	0.0000	0.0000	57.0810	115.4564	183.1991	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement												
	248.1223	219.3894	232.8264	203.9586	197.2394	177.2030	174.4312	181.6011	183.8782	205.6858	219.5241	245.3005 (64)
Efficiency of water heater												183.4483 (216)
(217)m	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483	183.4483 (217)
Fuel for water heating, kWh/month												
	135.2546	119.5920	126.9166	111.1804	107.5177	96.5956	95.0846	98.9931	100.2343	112.1219	119.6654	133.7164 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	2.1513	1.9431	2.1513	2.0819	2.1513	2.0819	2.1513	2.1513	2.0819	2.1513	2.0819	2.1513 (231)
Lighting	25.7918	20.6911	18.6301	13.6492	10.5430	8.6137	9.6177	12.5015	16.2382	21.3053	24.0643	26.5086 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-14.1379	-20.2247	-34.3422	-45.6445	-52.2595	-52.0248	-51.2235	-45.7284	-36.5960	-26.3936	-15.8852	-11.6741 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.7378	-5.5178	-13.4756	-25.7965	-37.0167	-43.4824	-42.7297	-33.8169	-21.9193	-10.1066	-3.8584	-2.0758 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	902.8231 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	183.4483
Water heating fuel used	1356.8727 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 2.3400, total flow = 21.0000, SFP = 0.1114)	
mechanical ventilation fans (SFP = 0.1114)	25.3297 (230a)
Total electricity for the above, kWh/year	25.3297 (231)
Electricity for lighting (calculated in Appendix L)	208.1547 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-648.6681 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	1844.5121 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	722.2585	27.8600	225.3446	(240)
Space heating - main system 1 (low-rate cost)	180.5646	0.1450	26.1819	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	949.8109	31.2000	296.3410	(245)
Low-rate cost	407.0618	14.5000	59.0240	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	25.3297	29.5300	6.6761	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	208.1547	29.5300	61.4681	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	29.5300	-119.9315	
PV Unit electricity exported	-242.5336	5.8100	-14.0912	
Total			-134.0227	(252)
Total energy cost			544.0130	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	722.2585	0.1634	118.0045	(261)
Space heating - main system 1 (low-rate cost)	180.5646	0.1372	24.7648	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	949.8109	0.1479	140.4793	(264)
Water heating - low rate cost	407.0618	0.1241	50.5290	(264)
Space and water heating			333.7776	(265)
Pumps, fans and electric keep-hot	25.3297	0.1432	3.5147	(267)
Energy for lighting	208.1547	0.1490	31.0192	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	0.1363	-55.3548	
PV Unit electricity exported	-242.5336	0.1205	-29.2173	
Total			-84.5721	(269)
Total CO2, kg/year			283.7394	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	722.2585	1.2872	1162.1377	(275)

Space heating - main system 1 (low-rate cost)	180.5646	1.4965	270.2092	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	949.8109	1.5529	1474.9254	(278)
Water heating - low rate cost	407.0618	1.4442	587.8840	(278)
Space and water heating			3495.1564	(279)
Pumps, fans and electric keep-hot	25.3297	1.5335	38.3227	(281)
Energy for lighting	208.1547	1.5547	323.6274	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-406.1345	1.5083	-612.5571	
PV Unit electricity exported	-242.5336	0.4418	-107.1500	
Total			-719.7070	(283)
Total Primary energy kWh/year			3137.3994	(286)

Full SAP Calculation Printout

Property Reference	HT2 Havant	**Issued on Date**	22/06/2025
Assessment Reference	2B4P ASHP	**Prop Type Ref**	2B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.44	**TER**	11.43
Environmental	96 A	**% DER < TER**			61.15
CO_2 Emissions (t/year)	0.32	**DFEE**	34.61	**TFEE**	36.76
Compliance Check	See BREL	**% DFEE < TFEE**			5.85
% DPER < TPER	21.85	**DPER**	46.60	**TPER**	59.63

Assessor Details	Mrs. Rebecca Lennon	**Assessor ID**	P627-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000 (1b)	x	2.4000 (2b)	=	94.8000	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6000 (2c)	=	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.5000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12636.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.9592 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.4000	0.0980	0.9212
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0450	0.5287
E4 Jamb	42.0000	0.0510	2.1420

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.7607 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 49.7009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	(38)
Heat transfer coeff	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	(39)
Average = Sum(39)m / 12 =												82.2884	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	(40)
HLP (average)												1.0416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4436 (42)
Hot water usage for mixer showers

65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)

Hot water usage for baths

28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)

Hot water usage for other uses

39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)

Average daily hot water use (litres/day) 122.2605 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)											Total = Sum(45)m =	2030.7208	
Distribution loss (46)m = 0.15 x (45)m	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
									Total per year (kWh/year) = Sum(64)m =		2566.7598	(64)

12Total per year (kWh/year) 2567 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

106.4608	94.5260	101.1727	90.5257	88.8699	81.2760	80.9849	83.4637	83.5838	91.7901	95.9070	105.4853	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.6220	121.3672	109.6220	113.2761	109.6220	113.2761	109.6220	109.6220	113.2761	109.6220	113.2761	109.6220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	143.0925	140.6637	135.9849	125.7301	119.4488	112.8833	108.8507	112.1824	116.0886	123.3737	133.2041	141.7813	(72)
Total internal gains	529.7065	541.2782	519.1709	500.4713	475.2632	457.9975	440.7213	441.7977	455.0412	470.7712	499.5284	518.8059	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	10.6334	0.3900	0.0000	0.7700	19.2870	(74)
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	115.6008	225.2688	372.9165	553.1343	690.1155	712.8054	675.9484	571.7425	436.1776	267.4399	143.8850	95.2824	(83)
Total gains	645.3074	766.5470	892.0874	1053.6056	1165.3787	1170.8028	1116.6697	1013.5402	891.2188	738.2111	643.4135	614.0883	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	
alpha	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	
util living area	0.9702	0.9447	0.8908	0.7705	0.6052	0.4381	0.3213	0.3681	0.5910	0.8477	0.9489	0.9749	(86)
Living	19.5405	19.8280	20.2225	20.6413	20.8829	20.9732	20.9937	20.9894	20.9199	20.5513	19.9597	19.4710	
Non living	18.3624	18.7212	19.2042	19.6918	19.9484	20.0313	20.0460	20.0439	19.9904	19.6059	18.8915	18.2751	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2534	19.8280	20.2225	20.6413	20.8829	20.9732	20.9937	20.9894	20.9199	20.5513	19.9597	19.6849	(87)
Th 2	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	(88)
util rest of house	0.9644	0.9344	0.8716	0.7354	0.5551	0.3770	0.2532	0.2943	0.5231	0.8136	0.9376	0.9700	(89)
MIT 2	19.3765	18.7212	19.2042	19.6918	19.9484	20.0313	20.0460	20.0439	19.9904	19.6059	18.8915	18.5947	(90)
Living area fraction										fLA = Living area / (4) =		0.1835	(91)
MIT	19.5374	18.9243	19.3911	19.8661	20.1200	20.2042	20.2200	20.2174	20.1610	19.7795	19.0876	18.7948	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5374	18.9243	19.3911	19.8661	20.1200	20.2042	20.2200	20.2174	20.1610	19.7795	19.0876	18.7948	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9607	0.9192	0.8561	0.7281	0.5590	0.3872	0.2655	0.3076	0.5315	0.8026	0.9230	0.9614	(94)
Useful gains	619.9161	704.6018	763.6972	767.1226	651.4581	453.2925	296.5206	311.7179	473.6544	592.4617	593.8687	590.3901	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1253.8647	1154.0399	1060.7850	902.3834	692.8645	461.1604	297.8824	314.1279	498.7491	755.3620	986.4397	1200.9821	(97)
Space heating kWh	471.6578	302.0224	221.0333	97.3878	30.8064	0.0000	0.0000	0.0000	0.0000	121.1978	282.6511	454.2804	(98a)
Space heating requirement - total per year (kWh/year)												1981.0370	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	471.6578	302.0224	221.0333	97.3878	30.8064	0.0000	0.0000	0.0000	0.0000	121.1978	282.6511	454.2804	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1981.0370	
Space heating per m2											(98c) / (4) =	25.0764	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 266.0949 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	471.6578	302.0224	221.0333	97.3878	30.8064	0.0000	0.0000	0.0000	0.0000	121.1978	282.6511	454.2804	(98)
Space heating efficiency (main heating system 1)	266.0949	266.0949	266.0949	266.0949	266.0949	0.0000	0.0000	0.0000	0.0000	266.0949	266.0949	266.0949	(210)
Space heating fuel (main heating system)	177.2517	113.5018	83.0656	36.5989	11.5772	0.0000	0.0000	0.0000	0.0000	45.5468	106.2219	170.7212	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
Efficiency of water heater												183.9873	(216)
(217)m	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	(217)
Fuel for water heating, kWh/month	139.2334	123.0912	130.5893	114.3076	110.4788	99.1877	97.5897	101.6415	102.9601	115.2521	123.1040	137.6388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.5597	2.3120	2.5597	2.4771	2.5597	2.4771	2.5597	2.5597	2.4771	2.5597	2.4771	2.5597	(231)
Lighting	26.4051	21.1832	19.0731	13.9738	10.7937	8.8186	9.8464	12.7987	16.6243	21.8120	24.6366	27.1390	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 744.4852 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.9873

Water heating fuel used 1395.0742 (219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 4.6280, total flow = 37.0000, SFP = 0.1251)		
mechanical ventilation fans (SFP = 0.1251)	30.1383	(230a)
Total electricity for the above, kWh/year	30.1383	(231)
Electricity for lighting (calculated in Appendix L)	213.1046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2382.8023	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	595.5882	0.1643	97.8632	(261)
Space heating - main system 1 (low-rate cost)	148.8970	0.1379	20.5392	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.5519	0.1479	144.4535	(264)
Water heating - low rate cost	418.5223	0.1241	51.9585	(264)
Space and water heating			314.8143	(265)
Pumps, fans and electric keep-hot	30.1383	0.1432	4.1819	(267)
Energy for lighting	213.1046	0.1490	31.7568	(268)
Total CO2, kg/year			350.7530	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	595.5882	1.2899	960.3130	(275)
Space heating - main system 1 (low-rate cost)	148.8970	1.4996	223.2834	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	976.5519	1.5529	1516.5200	(278)
Water heating - low rate cost	418.5223	1.4443	604.4631	(278)
Space and water heating			3304.5794	(279)
Pumps, fans and electric keep-hot	30.1383	1.5335	45.5979	(281)
Energy for lighting	213.1046	1.5547	331.3232	(282)
Total Primary energy kWh/year			3681.5005	(286)
Dwelling Primary energy Rate (DPER)			46.6000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000 (1b)	x	2.4000 (2b)	=	94.8000	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6000 (2c)	=	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.5000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 = 0.0000	(6a)
Number of open flues	0 * 20 = 0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000	(6d)
Number of flues attached to other heater	0 * 35 = 0.0000	(6e)
Number of blocked chimneys	0 * 20 = 0.0000	(6f)
Number of intermittent extract fans	3 * 10 = 30.0000	(7a)
Number of passive vents	0 * 10 = 0.0000	(7b)
Number of flueless gas fires	0 * 40 = 0.0000	(7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.1519	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4019	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.3416	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.4356	0.4270	0.4185	0.3758	0.3672	0.3245	0.3245	0.3160	0.3416	0.3672	0.3843	0.4014	(22b)
Effective ac	0.5949	0.5912	0.5876	0.5706	0.5674	0.5527	0.5527	0.5499	0.5584	0.5674	0.5738	0.5806	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.8000	1.1450	20.3817			(27)
Heatloss Floor 1			39.5000	0.1300	5.1350			(28a)
External Wall 1	89.0000	19.7600	69.2400	0.1800	12.4632			(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450			(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.2849			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.9592	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.4000	0.0600	0.5640
E12 Gable (insulation at ceiling level)	8.4000	0.0600	0.5040
P1 Party wall - Ground floor	8.4000	0.0800	0.6720
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.1200	1.0080
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0500	0.5875
E4 Jamb	42.0000	0.0500	2.1000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.0695	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	50.3544	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.7697	38.5296	38.2943	37.1891	36.9823	36.0197	36.0197	35.8414	36.3905	36.9823	37.4006	37.8380	(38)
Heat transfer coeff													
	89.1241	88.8840	88.6487	87.5435	87.3367	86.3741	86.3741	86.1958	86.7448	87.3367	87.7550	88.1923	(39)
Average = Sum(39)m / 12 =												87.5425	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1282	1.1251	1.1221	1.1081	1.1055	1.0933	1.0933	1.0911	1.0980	1.1055	1.1108	1.1164	(40)
HLP (average)												1.1081	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4436	(42)
Hot water usage for mixer showers													
	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)
Hot water usage for baths													
	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)
Hot water usage for other uses													
	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)
Average daily hot water use (litres/day)												122.2605	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)										Total = Sum(45)m =		2030.7208	
Distribution loss (46)m = 0.15 x (45)m													
	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.3918	232.0903	246.4878	216.3308	209.4869	188.5122	185.7726	193.2276	195.4529	218.2692	232.5151	259.4580	(62)
WWHRS	-29.8026	-26.3577	-27.6003	-22.8541	-21.2992	-18.2259	-17.0839	-18.1670	-18.8572	-22.2306	-25.1845	-29.2507	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	232.5892	205.7326	218.8876	193.4767	188.1877	170.2863	168.6887	175.0606	176.5957	196.0387	207.3306	230.2072	(64)
										Total per year (kWh/year) = Sum(64)m =		2363.0816	(64)
12Total per year (kWh/year)												2363	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.4368	99.0204	106.1487	95.3412	93.8459	86.0915	85.9609	88.4397	88.3992	96.7660	100.7224	110.4613	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.6049	121.3483	109.6049	113.2584	109.6049	113.2584	109.6049	109.6049	113.2584	109.6049	113.2584	109.6049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	149.7807	147.3518	142.6730	132.4183	126.1370	119.5715	115.5389	118.8706	122.7767	130.0619	139.8923	148.4695	(72)
Total internal gains													
	539.3776	550.9475	528.8420	510.1418	484.9343	464.6680	447.3924	448.4687	461.7117	480.4423	509.1989	528.4769	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.8000	10.6334	0.6300	0.7000	0.7700	15.5986	(74)
East	7.3900	19.6403	0.6300	0.7000	0.7700	44.3571	(76)
West	5.6100	19.6403	0.6300	0.7000	0.7700	33.6730	(80)

Solar gains	93.6287	182.4532	302.0361	447.9891	558.9175	577.2866	547.4399	463.0552	353.2703	216.6089	116.5373	77.1719	(83)
Total gains	633.0063	733.4007	830.8781	958.1309	1043.8517	1041.9546	994.8323	911.5239	814.9820	697.0513	625.7362	605.6489	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.3857	39.4921	39.5969	40.0968	40.1918	40.6397	40.6397	40.7238	40.4660	40.1918	40.0002	39.8018	
alpha	3.6257	3.6328	3.6398	3.6731	3.6795	3.7093	3.7093	3.7149	3.6977	3.6795	3.6667	3.6535	
util living area													
	0.9736	0.9550	0.9168	0.8236	0.6788	0.5055	0.3753	0.4236	0.6530	0.8764	0.9559	0.9771	(86)
MIT	19.3364	19.6051	19.9994	20.4819	20.8011	20.9499	20.9871	20.9800	20.8725	20.4293	19.8088	19.2974	(87)
Th 2	19.9779	19.9804	19.9828	19.9942	19.9963	20.0063	20.0063	20.0081	20.0024	19.9963	19.9920	19.9875	(88)
util rest of house													
	0.9682	0.9461	0.9004	0.7913	0.6265	0.4353	0.2935	0.3370	0.5811	0.8453	0.9456	0.9724	(89)
MIT 2	18.0578	18.3964	18.8867	19.4700	19.8224	19.9731	20.0007	19.9987	19.9076	19.4266	18.6652	18.0149	(90)
Living area fraction									fLA = Living area / (4) =			0.1835	(91)
MIT	18.2924	18.6183	19.0909	19.6557	20.0021	20.1524	20.1817	20.1788	20.0847	19.6106	18.8751	18.2503	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2924	18.6183	19.0909	19.6557	20.0021	20.1524	20.1817	20.1788	20.0847	19.6106	18.8751	18.2503	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9560	0.9305	0.8830	0.7791	0.6268	0.4459	0.3082	0.3523	0.5874	0.8312	0.9306	0.9612	(94)
Useful gains	605.1252	682.4638	733.6278	746.4946	654.2724	464.6385	306.5580	321.1079	478.7234	579.4018	582.3292	582.1632	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1247.0636	1219.3332	1116.1682	941.5936	725.0737	479.5815	309.3689	325.7206	519.1398	786.9585	1033.3215	1239.1305	(97)
Space heating kWh													
	477.6021	360.7762	284.6101	140.4713	52.6762	0.0000	0.0000	0.0000	0.0000	154.4222	324.7145	488.7836	(98a)
Space heating requirement - total per year (kWh/year)												2284.0562	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	477.6021	360.7762	284.6101	140.4713	52.6762	0.0000	0.0000	0.0000	0.0000	154.4222	324.7145	488.7836	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2284.0562	
Space heating per m2											(98c) / (4) =	28.9121	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	477.6021	360.7762	284.6101	140.4713	52.6762	0.0000	0.0000	0.0000	0.0000	154.4222	324.7145	488.7836	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	517.4454	390.8735	308.3533	152.1899	57.0706	0.0000	0.0000	0.0000	0.0000	167.3047	351.8033	529.5597	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	232.5892	205.7326	218.8876	193.4767	188.1877	170.2863	168.6887	175.0606	176.5957	196.0387	207.3306	230.2072	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6369	85.3061	84.6496	83.3535	81.6089	79.8000	79.8000	79.8000	79.8000	83.5303	85.0616	85.7051	(217)
Fuel for water heating, kWh/month													
	271.5993	241.1700	258.5807	232.1158	230.5971	213.3913	211.3894	219.3742	221.2979	234.6917	243.7417	268.6038	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.7737	18.2699	16.4501	12.0520	9.3093	7.6058	8.4923	11.0386	14.3380	18.8123	21.2484	23.4067	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8228	-51.8486	-74.4438	-83.6129	-90.0919	-84.0663	-83.0157	-78.3913	-70.2379	-59.2263	-40.4542	-31.8421	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.0130	-44.1777	-87.7586	-131.7423	-174.1372	-174.9483	-172.9003	-146.4340	-107.3772	-63.1714	-28.0529	-16.6197	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2474.6005	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2846.5529	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	183.7971	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1952.3865	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3638.5640	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2474.6005	0.2100	519.6661	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2846.5529	0.2100	597.7761	(264)
Space and water heating			1117.4422	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.7971	0.1443	26.5276	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-784.0538	0.1346	-105.5417	
PV Unit electricity exported	-1168.3327	0.1259	-147.1042	
Total			-252.6460	(269)
Total CO2, kg/year			903.2531	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2474.6005	1.1300	2796.2985	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2846.5529	1.1300	3216.6047	(278)
Space and water heating			6012.9033	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.7971	1.5338	281.9141	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-784.0538	1.4975	-1174.1192	
PV Unit electricity exported	-1168.3327	0.4622	-539.9743	
Total			-1714.0935	(283)
Total Primary energy kWh/year			4710.8246	(286)
Target Primary Energy Rate (TPER)			59.6300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000 (1b)	x	2.4000 (2b)	=	94.8000	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6000 (2c)	=	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 79.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)

Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1519 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3519 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2991 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3814	0.3739	0.3664	0.3290	0.3215	0.2842	0.2842	0.2767	0.2991	0.3215	0.3365	0.3515	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5727	0.5699	0.5671	0.5541	0.5517	0.5404	0.5404	0.5383	0.5447	0.5517	0.5566	0.5618	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12636.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.9592 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.4000	0.0980	0.9212
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0450	0.5287
E4 Jamb	42.0000	0.0510	2.1420

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.7607 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	49.7009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.3271	37.1431	36.9627	36.1153	35.9568	35.2188	35.2188	35.0821	35.5031	35.9568	36.2775	36.6128	(38)
Heat transfer coeff	87.0280	86.8440	86.6636	85.8162	85.6577	84.9197	84.9197	84.7830	85.2039	85.6577	85.9784	86.3137	(39)
Average = Sum(39)m / 12 =												85.8155	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1016	1.0993	1.0970	1.0863	1.0843	1.0749	1.0749	1.0732	1.0785	1.0843	1.0883	1.0926	(40)
HLP (average)												1.0863	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4436 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)

Hot water usage for other uses

39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)

Average daily hot water use (litres/day)	62.1565 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	67.8126	65.9524	63.9215	61.3937	59.1387	56.7951	56.3082	58.3349	60.4137	62.8203	65.3705	67.7174	(44)
Energy conte	107.3985	93.9153	98.2450	84.0449	79.6120	69.8362	68.0999	72.2309	74.4961	85.2466	93.1322	106.0290	(45)
Energy content (annual)										Total = Sum(45)m =		1032.2865	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	91.2887	79.8280	83.5082	71.4382	67.6702	59.3608	57.8849	61.3962	63.3217	72.4596	79.1624	90.1247	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	91.2887	79.8280	83.5082	71.4382	67.6702	59.3608	57.8849	61.3962	63.3217	72.4596	79.1624	90.1247	(64)

											Total per year (kWh/year) = Sum(64)m =	877.4435	(64)
12Total per year (kWh/year)												877	(64)
Electric shower(s)													
52.2072	46.5170	50.7948	48.4729	49.3824	47.1061	48.6763	49.3824	48.4729	50.7948	49.8397	52.2072	(64a)	
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	593.8536	(64a)	
Heat gains from water heating, kWh/month													
35.8740	31.5863	33.5758	29.9778	29.2632	26.6167	26.6403	27.6947	27.9486	30.8136	32.2505	35.5830	(65)	

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.6220	121.3672	109.6220	113.2761	109.6220	113.2761	109.6220	109.6220	113.2761	109.6220	113.2761	109.6220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	48.2177	47.0034	45.1287	41.6358	39.3322	36.9677	35.8068	37.2240	38.8175	41.4161	44.7924	47.8266	(72)
Total internal gains													
	434.8318	447.6179	428.3148	416.3769	395.1465	382.0818	367.6774	366.8393	377.7701	388.8136	411.1167	424.8511	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	10.6334	0.3900	0.0000	0.7700	19.2870	(74)
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	115.6008	225.2688	372.9165	553.1343	690.1155	712.8054	675.9484	571.7425	436.1776	267.4399	143.8850	95.2824	(83)
Total gains	550.4326	672.8867	801.2312	969.5113	1085.2620	1094.8872	1043.6258	938.5818	813.9477	656.2535	555.0017	520.1335	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3343	40.4198	40.5040	40.9039	40.9796	41.3357	41.3357	41.4024	41.1978	40.9796	40.8267	40.6681	
alpha	3.6890	3.6947	3.7003	3.7269	3.7320	3.7557	3.7557	3.7602	3.7465	3.7320	3.7218	3.7112	
util living area													
	0.9825	0.9641	0.9221	0.8146	0.6539	0.4777	0.3531	0.4064	0.6469	0.8899	0.9683	0.9856	(86)
MIT	19.2472	19.5596	20.0042	20.5206	20.8322	20.9604	20.9901	20.9835	20.8814	20.4080	19.7324	19.1953	(87)
Th 2	19.9995	20.0014	20.0033	20.0121	20.0137	20.0214	20.0214	20.0228	20.0184	20.0137	20.0104	20.0069	(88)
util rest of house													
	0.9788	0.9567	0.9066	0.7819	0.6020	0.4109	0.2767	0.3239	0.5758	0.8614	0.9606	0.9825	(89)
MIT 2	18.4101	18.7182	19.1498	19.6349	19.9002	20.0011	20.0180	20.0168	19.9497	19.5486	18.8986	18.3641	(90)
Living area fraction										fLA = Living area / (4) =		0.1835	(91)
MIT	18.5637	18.8726	19.3066	19.7975	20.0713	20.1772	20.1964	20.1942	20.1207	19.7064	19.0516	18.5167	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5637	18.8726	19.3066	19.7975	20.0713	20.1772	20.1964	20.1942	20.1207	19.7064	19.0516	18.5167	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9462	0.8937	0.7740	0.6052	0.4218	0.2906	0.3387	0.5837	0.8509	0.9509	0.9763	(94)
Useful gains	534.8359	636.6784	716.0998	750.4087	656.7652	461.8470	303.2637	317.8886	475.1107	558.4132	527.7333	507.7857	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1241.3445	1213.4384	1109.8682	935.1825	717.0627	473.6124	305.4090	321.6835	512.9860	780.0290	1027.5798	1235.7249	(97)	
Space heating kWh													
525.6424	387.5827	292.9637	133.0372	44.8613	0.0000	0.0000	0.0000	0.0000	164.8821	359.8895	541.5868	(98a)	
Space heating requirement - total per year (kWh/year)												2450.4457	
Solar heating kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)	
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
525.6424	387.5827	292.9637	133.0372	44.8613	0.0000	0.0000	0.0000	0.0000	164.8821	359.8895	541.5868	(98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												2450.4457	
Space heating per m2											(98c) / (4) =	31.0183	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	798.2450	628.4056	644.3509	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9219	0.9538	0.9333	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	735.9192	599.3904	601.3845	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1237.6767	1179.8961	1059.2556	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	361.2654	431.8962	340.6560	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)

Space cooling kWh

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	90.3164	107.9741	85.1640	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 283.4544 (107)
Energy for space heating 31.0183 (99)
Energy for space cooling 3.5880 (108)
Total 34.6063 (109)
Fabric Energy Efficiency (DFEE) 34.6 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000 (1b)	x	2.4000 (2b)	=	94.8000	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6000 (2c)	=	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.5000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1519	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4019	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3416	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4356	0.4270	0.4185	0.3758	0.3672	0.3245	0.3245	0.3160	0.3416	0.3672	0.3843	0.4014	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

Effective ac	0.5949	0.5912	0.5876	0.5706	0.5674	0.5527	0.5527	0.5499	0.5584	0.5674	0.5738	0.5806	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.8000	1.1450	20.3817			(27)
Heatloss Floor 1			39.5000	0.1300	5.1350			(28a)
External Wall 1	89.0000	19.7600	69.2400	0.1800	12.4632			(29a)
External Roof 1	39.5000		39.5000	0.1100	4.3450			(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.2849			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 159.9592 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.4000	0.0600	0.5640
E12 Gable (insulation at ceiling level)	8.4000	0.0600	0.5040
P1 Party wall - Ground floor	8.4000	0.0800	0.6720
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.1200	1.0080
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0500	0.5875
E4 Jamb	42.0000	0.0500	2.1000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.0695 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.3544 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.7697	38.5296	38.2943	37.1891	36.9823	36.0197	36.0197	35.8414	36.3905	36.9823	37.4006	37.8380	(38)
Heat transfer coeff	89.1241	88.8840	88.6487	87.5435	87.3367	86.3741	86.3741	86.1958	86.7448	87.3367	87.7550	88.1923	(39)

Average = Sum(39)m / 12 = 87.5425

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	1.1282	1.1251	1.1221	1.1081	1.1055	1.0933	1.0933	1.0911	1.0980	1.1055	1.1108	1.1164	(40)
HLP (average)												1.1081	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4436	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)
Hot water usage for other uses													
	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)
Average daily hot water use (litres/day)												62.1565	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	67.8126	65.9524	63.9215	61.3937	59.1387	56.7951	56.3082	58.3349	60.4137	62.8203	65.3705	67.7174	(44)
Energy conte	107.3985	93.9153	98.2450	84.0449	79.6120	69.8362	68.0999	72.2309	74.4961	85.2466	93.1322	106.0290	(45)
Energy content (annual)											Total = Sum(45)m =	1032.2865	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	91.2887	79.8280	83.5082	71.4382	67.6702	59.3608	57.8849	61.3962	63.3217	72.4596	79.1624	90.1247	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	91.2887	79.8280	83.5082	71.4382	67.6702	59.3608	57.8849	61.3962	63.3217	72.4596	79.1624	90.1247	(64)
										Total per year (kWh/year) = Sum(64)m =		877.4435	(64)
12Total per year (kWh/year)												877	(64)
Electric shower(s)													
	52.2072	46.5170	50.7948	48.4729	49.3824	47.1061	48.6763	49.3824	48.4729	50.7948	49.8397	52.2072	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		593.8536	(64a)
Heat gains from water heating, kWh/month													
	35.8740	31.5863	33.5758	29.9778	29.2632	26.6167	26.6403	27.6947	27.9486	30.8136	32.2505	35.5830	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.6049	121.3483	109.6049	113.2584	109.6049	113.2584	109.6049	109.6049	113.2584	109.6049	113.2584	109.6049	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	48.2177	47.0034	45.1287	41.6358	39.3322	36.9677	35.8068	37.2240	38.8175	41.4161	44.7924	47.8266	(72)
Total internal gains													
	434.8147	447.5990	428.2977	416.3593	395.1295	382.0642	367.6603	366.8222	377.7525	388.7965	411.0991	424.8340	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.8000	10.6334	0.6300	0.7000	0.7700	15.5986	(74)
East	7.3900	19.6403	0.6300	0.7000	0.7700	44.3571	(76)
West	5.6100	19.6403	0.6300	0.7000	0.7700	33.6730	(80)

Solar gains	93.6287	182.4532	302.0361	447.9891	558.9175	577.2866	547.4399	463.0552	353.2703	216.6089	116.5373	77.1719	(83)
Total gains	528.4434	630.0522	730.3338	864.3484	954.0469	959.3508	915.1002	829.8774	731.0228	605.4055	527.6363	502.0059	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.3857	39.4921	39.5969	40.0968	40.1918	40.6397	40.6397	40.7238	40.4660	40.1918	40.0002	39.8018	
alpha	3.6257	3.6328	3.6398	3.6731	3.6795	3.7093	3.7093	3.7149	3.6977	3.6795	3.6667	3.6535	
util living area													
	0.9848	0.9709	0.9405	0.8579	0.7190	0.5421	0.4058	0.4612	0.7025	0.9118	0.9732	0.9872	(86)
MIT	19.1534	19.4358	19.8565	20.3906	20.7578	20.9369	20.9833	20.9735	20.8365	20.3164	19.6466	19.1133	(87)
Th 2	19.9779	19.9804	19.9828	19.9942	19.9963	20.0063	20.0063	20.0081	20.0024	19.9963	19.9920	19.9875	(88)
util rest of house													
	0.9815	0.9648	0.9279	0.8293	0.6678	0.4689	0.3183	0.3686	0.6312	0.8872	0.9665	0.9845	(89)
MIT 2	18.3018	18.5819	18.9940	19.5063	19.8285	19.9732	20.0005	19.9983	19.9051	19.4523	18.8013	18.2690	(90)
Living area fraction										fLA = Living area / (4) =		0.1835	(91)
MIT	18.4581	18.7386	19.1523	19.6686	19.9991	20.1501	20.1809	20.1773	20.0761	19.6109	18.9565	18.4239	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4581	18.7386	19.1523	19.6686	19.9991	20.1501	20.1809	20.1773	20.0761	19.6109	18.9565	18.4239	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9748	0.9550	0.9152	0.8187	0.6679	0.4799	0.3340	0.3849	0.6369	0.8757	0.9573	0.9786	(94)
Useful gains	515.1198	601.7281	668.4190	707.6674	637.2504	460.3665	305.6134	319.3884	465.5830	530.1410	505.1218	491.2472	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1261.8278	1230.0303	1121.6079	942.7219	724.8123	479.3865	309.2985	325.5838	518.3955	786.9800	1040.4648	1254.4431	(97)
Space heating kWh	555.5507	422.2191	337.1725	169.2392	65.1460	0.0000	0.0000	0.0000	0.0000	191.0883	385.4469	567.8177	(98a)
Space heating requirement - total per year (kWh/year)												2693.6804	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	555.5507	422.2191	337.1725	169.2392	65.1460	0.0000	0.0000	0.0000	0.0000	191.0883	385.4469	567.8177	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2693.6804	
Space heating per m2											(98c) / (4) =	34.0972	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	811.9161	639.1680	655.0880	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8833	0.9277	0.9011	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.1398	592.9318	590.2964	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1079.2767	1029.6897	932.2163	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	260.7385	324.9479	254.3884	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	65.1846	81.2370	63.5971	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												210.0187	(107)
Energy for space heating												34.0972	(99)
Energy for space cooling												2.6585	(108)
Total												36.7557	(109)
Fabric Energy Efficiency (TFEE)												36.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area		Storey height		Volume	
Main dwelling	(m2)		(m)		(m3)	
Ground floor	39.5000	(1b) x	2.4000	(2b) =	94.8000	(1b) - (3b)
First floor	39.5000	(1c) x	2.6000	(2c) =	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		197.5000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12636.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.9592 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.4000	0.0980	0.9212
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0450	0.5287
E4 Jamb	42.0000	0.0510	2.1420

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.7607 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	49.7009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	(38)
Heat transfer coeff	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	(39)
Average = Sum(39)m / 12 =												82.2884	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	(40)
HLP (average)												1.0416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4436 (42)
Hot water usage for mixer showers	65.1911 64.2114 62.7838 60.0523 58.0365 55.7886 54.5108 55.9276 57.4807 59.8943 62.6845 64.9413	(42a)
Hot water usage for baths	28.1575 27.7393 27.1505 26.0647 25.2516 24.3501 23.8631 24.4479 25.0846 26.0493 27.1574 28.0623	(42b)
Hot water usage for other uses	39.6550 38.2130 36.7710 35.3290 33.8870 32.4450 32.4450 33.8870 35.3290 36.7710 38.2130 39.6550	(42c)
Average daily hot water use (litres/day)		122.2605 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)										Total = Sum(45)m =		2030.7208	
Distribution loss (46)m = 0.15 x (45)m	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.7598	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.4608	94.5260	101.1727	90.5257	88.8699	81.2760	80.9849	83.4637	83.5838	91.7901	95.9070	105.4853	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	30.1672	26.7942	21.7905	16.4968	12.3316	10.4108	11.2493	14.6222	19.6259	24.9196	29.0849	31.0056	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	143.0925	140.6637	135.9849	125.7301	119.4488	112.8833	108.8507	112.1824	116.0886	123.3737	133.2041	141.7813	(72)
Total internal gains													
	598.6221	596.1864	578.0214	544.4148	511.1731	481.2626	463.7557	467.0942	484.4866	515.1236	551.9144	583.8366	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	10.6334	0.3900	0.0000	0.7700	19.2870	(74)
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	115.6008	225.2688	372.9165	553.1343	690.1155	712.8054	675.9484	571.7425	436.1776	267.4399	143.8850	95.2824	(83)
Total gains	714.2229	821.4551	950.9379	1097.5492	1201.2886	1194.0679	1139.7041	1038.8367	920.6642	782.5635	695.7994	679.1190	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	
alpha	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	
util living area													
	0.9595	0.9329	0.8727	0.7532	0.5910	0.4302	0.3150	0.3596	0.5759	0.8275	0.9363	0.9658	(86)
Living	19.6560	19.9103	20.2913	20.6704	20.8921	20.9748	20.9941	20.9902	20.9267	20.5937	20.0395	19.5826	
Non living	18.5065	18.8219	19.2847	19.7227	19.9567	20.0324	20.0462	20.0443	19.9957	19.6519	18.9887	18.4148	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3124	19.9103	20.2913	20.6704	20.8921	20.9748	20.9941	20.9902	20.9267	20.5937	20.0395	19.7808	(87)
Th 2	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	(88)
util rest of house													
	0.9519	0.9209	0.8515	0.7172	0.5413	0.3700	0.2481	0.2873	0.5087	0.7910	0.9228	0.9593	(89)
MIT 2	19.4339	18.8219	19.2847	19.7227	19.9567	20.0324	20.0462	20.0443	19.9957	19.6519	18.9887	18.7092	(90)
Living area fraction									fLA = Living area / (4) =			0.1835	(91)
MIT	19.5952	19.0216	19.4695	19.8967	20.1284	20.2054	20.2202	20.2179	20.1666	19.8248	19.1815	18.9059	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5952	19.0216	19.4695	19.8967	20.1284	20.2054	20.2202	20.2179	20.1666	19.8248	19.1815	18.9059	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9476	0.9050	0.8367	0.7110	0.5456	0.3801	0.2603	0.3003	0.5173	0.7813	0.9074	0.9493	(94)
Useful gains	676.8204	743.4502	795.6062	780.3671	655.4049	453.8716	296.6331	311.9510	476.2907	611.4159	631.3878	644.6719	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1258.6145	1162.0465	1067.2386	904.8982	693.5583	461.2579	297.9015	314.1674	499.2078	759.0924	994.1707	1210.1261	(97)
Space heating kWh													
	432.8548	281.2967	202.0946	89.6624	28.3862	0.0000	0.0000	0.0000	0.0000	109.8713	261.2037	420.6979	(98a)
Space heating requirement - total per year (kWh/year)												1826.0676	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	432.8548	281.2967	202.0946	89.6624	28.3862	0.0000	0.0000	0.0000	0.0000	109.8713	261.2037	420.6979	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1826.0676	
Space heating per m2											(98c) / (4) =	23.1148	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.0949	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	432.8548	281.2967	202.0946	89.6624	28.3862	0.0000	0.0000	0.0000	0.0000	109.8713	261.2037	420.6979	(98)
Space heating efficiency (main heating system 1)													
	266.0949	266.0949	266.0949	266.0949	266.0949	0.0000	0.0000	0.0000	0.0000	266.0949	266.0949	266.0949	(210)
Space heating fuel (main heating system)													
	162.6693	105.7129	75.9483	33.6956	10.6677	0.0000	0.0000	0.0000	0.0000	41.2903	98.1619	158.1007	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
Efficiency of water heater												183.9873	(216)
(217)m	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	(217)
Fuel for water heating, kWh/month													
	139.2334	123.0912	130.5893	114.3076	110.4788	99.1877	97.5897	101.6415	102.9601	115.2521	123.1040	137.6388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	2.5597	2.3120	2.5597	2.4771	2.5597	2.4771	2.5597	2.5597	2.4771	2.5597	2.4771	2.5597	(231)
Lighting	26.4051	21.1832	19.0731	13.9738	10.7937	8.8186	9.8464	12.7987	16.6243	21.8120	24.6366	27.1390	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	686.2468	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.9873	
Water heating fuel used	1395.0742	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 4.6280, total flow = 37.0000, SFP = 0.1251)		
mechanical ventilation fans (SFP = 0.1251)	30.1383	(230a)
Total electricity for the above, kWh/year	30.1383	(231)
Electricity for lighting (calculated in Appendix L)	213.1046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2324.5639	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	548.9974	17.5600	107.6035	(240)
Space heating - main system 1 (low-rate cost)	137.2494	0.0940	12.9014	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	976.5519	19.6000	191.4042	(245)
Low-rate cost	418.5223	9.4000	39.3411	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	30.1383	18.5800	5.0156	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	213.1046	18.5800	39.5948	(250)
Additional standing charges			7.0000	(251)
Total energy cost			402.8607	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1696	(257)
SAP value		81.0409	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	548.9974	0.1643	90.2238	(261)
Space heating - main system 1 (low-rate cost)	137.2494	0.1380	18.9360	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.5519	0.1479	144.4535	(264)
Water heating - low rate cost	418.5223	0.1241	51.9585	(264)
Space and water heating			305.5717	(265)
Pumps, fans and electric keep-hot	30.1383	0.1432	4.1819	(267)
Energy for lighting	213.1046	0.1490	31.7568	(268)
Total CO2, kg/year			341.5104	(272)
CO2 emissions per m2			4.3200	(273)
EI value			96.3095	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000 (1b)	x	2.4000 (2b)	=	94.8000	(1b) - (3b)
First floor	39.5000 (1c)	x	2.6000 (2c)	=	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	197.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12636.7800	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.9592	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	9.4000	0.0980	0.9212
E10 Eaves (insulation at ceiling level)	8.4000	0.0970	0.8148
E12 Gable (insulation at ceiling level)	8.4000	0.3200	2.6880
P1 Party wall - Ground floor	8.4000	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.4800	4.0320
P4 Party wall - Roof (insulation at ceiling level)	12.6800	0.0500	0.6340
E1 Steel lintel with perforated steel base plate	11.7500	0.0450	0.5287
E3 Sill	42.0000	0.0510	2.1420
E4 Jamb			

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.7607	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	49.7009	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	(38)
Heat transfer coeff	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	(39)
Average = Sum(39)m / 12 =												82.2884	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	(40)
HLP (average)												1.0416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)

Hot water usage for baths

28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)

Hot water usage for other uses

39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)

Average daily hot water use (litres/day)	122.2605	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)										Total = Sum(45)m =		2030.7208	
Distribution loss (46)m = 0.15 x (45)m													
	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
										Total per year (kWh/year) = Sum(64)m =		2566.7598	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.4608	94.5260	101.1727	90.5257	88.8699	81.2760	80.9849	83.4637	83.5838	91.7901	95.9070	105.4853	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.1672	26.7942	21.7905	16.4968	12.3316	10.4108	11.2493	14.6222	19.6259	24.9196	29.0849	31.0056	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	143.0925	140.6637	135.9849	125.7301	119.4488	112.8833	108.8507	112.1824	116.0886	123.3737	133.2041	141.7813	(72)
Total internal gains													
	598.6221	596.1864	578.0214	544.4148	511.1731	481.2626	463.7557	467.0942	484.4866	515.1236	551.9144	583.8366	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	14.2607	0.3900	0.0000	0.7700	25.8662	(74)
East	9.2900	26.6540	0.3900	0.0000	0.7700	74.3591	(76)
West	7.0400	26.6540	0.3900	0.0000	0.7700	56.3496	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	156.5749	257.9264	421.4859	639.7947	768.6398	848.2858	808.0782	687.0167	528.6510	326.7011	187.8339	128.6057	(83)
Total gains	755.1969	854.1128	999.5074	1184.2095	1279.8129	1329.5484	1271.8339	1154.1109	1013.1375	841.8246	739.7483	712.4423	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	
alpha	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	
util living area													
	0.9430	0.9146	0.8358	0.6805	0.4942	0.3190	0.2131	0.2346	0.4498	0.7399	0.9008	0.9500	(86)
Living	19.8689	20.0678	20.4465	20.7901	20.9495	20.9927	20.9989	20.9984	20.9739	20.7704	20.2933	19.8320	
Non living	18.7729	19.0159	19.4682	19.8515	20.0100	20.0450	20.0485	20.0484	20.0332	19.8441	19.2987	18.7284	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4214	20.0678	20.4465	20.7901	20.9495	20.9927	20.9989	20.9984	20.9739	20.7704	20.2933	19.9954	(87)
Th 2	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	(88)
util rest of house													
	0.9322	0.8994	0.8093	0.6387	0.4411	0.2618	0.1519	0.1673	0.3796	0.6896	0.8796	0.9401	(89)
MIT 2	19.5401	19.0159	19.4682	19.8515	20.0100	20.0450	20.0485	20.0484	20.0332	19.8441	19.2987	18.9663	(90)
Living area fraction										fLA = Living area / (4) =		0.1835	(91)
MIT	19.7019	19.2090	19.6478	20.0238	20.1825	20.2189	20.2229	20.2228	20.2059	20.0141	19.4813	19.1552	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7019	19.2090	19.6478	20.0238	20.1825	20.2189	20.2229	20.2228	20.2059	20.0141	19.4813	19.1552	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9277	0.8833	0.7968	0.6375	0.4487	0.2721	0.1631	0.1797	0.3914	0.6876	0.8646	0.9286	(94)
Useful gains	700.5709	754.4503	796.4434	754.9313	574.3155	361.8138	207.4447	207.3601	396.5452	578.8763	639.5822	661.6073	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)

Heat loss rate W

	1185.1086	1111.6335	1007.8475	833.0672	591.0352	363.6270	207.6084	207.5931	403.6956	659.4673	903.6304	1123.6660 (97)
Space heating kWh												
	360.4960	240.0271	157.2847	56.2578	12.4395	0.0000	0.0000	0.0000	0.0000	59.9597	190.1147	343.7717 (98a)
Space heating requirement - total per year (kWh/year)												1420.3511
Solar heating kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)												0.0000
Space heating kWh												
	360.4960	240.0271	157.2847	56.2578	12.4395	0.0000	0.0000	0.0000	0.0000	59.9597	190.1147	343.7717 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1420.3511
Space heating per m2											(98c) / (4) =	17.9791 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	266.0949 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	360.4960	240.0271	157.2847	56.2578	12.4395	0.0000	0.0000	0.0000	0.0000	59.9597	190.1147	343.7717	(98)
Space heating efficiency (main heating system 1)													
	266.0949	266.0949	266.0949	266.0949	266.0949	0.0000	0.0000	0.0000	0.0000	266.0949	266.0949	266.0949	(210)
Space heating fuel (main heating system)													
	135.4765	90.2036	59.1085	21.1420	4.6748	0.0000	0.0000	0.0000	0.0000	22.5332	71.4462	129.1914	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	256.1718	226.4722	240.2678	210.3115	203.2669	182.4928	179.5526	187.0076	189.4336	212.0492	226.4958	253.2380	(64)
Efficiency of water heater												183.9873	(216)
(217)m	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	(217)
Fuel for water heating, kWh/month													
	139.2334	123.0912	130.5893	114.3076	110.4788	99.1877	97.5897	101.6415	102.9601	115.2521	123.1040	137.6388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.5597	2.3120	2.5597	2.4771	2.5597	2.4771	2.5597	2.5597	2.4771	2.5597	2.4771	2.5597	(231)
Lighting	26.4051	21.1832	19.0731	13.9738	10.7937	8.8186	9.8464	12.7987	16.6243	21.8120	24.6366	27.1390	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	533.7762 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	183.9873
Water heating fuel used	1395.0742 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 4.6280, total flow = 37.0000, SFP = 0.1251)	
mechanical ventilation fans (SFP = 0.1251)	30.1383 (230a)
Total electricity for the above, kWh/year	30.1383 (231)
Electricity for lighting (calculated in Appendix L)	213.1046 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2172.0933 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	427.0210	27.8600	133.2305	(240)
Space heating - main system 1 (low-rate cost)	106.7552	0.1450	15.4795	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	976.5519	31.2000	304.6842	(245)
Low-rate cost	418.5223	14.5000	60.6857	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	30.1383	29.5300	7.9435	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	213.1046	29.5300	62.9298	(250)
Additional standing charges			3.0000	(251)
Total energy cost			587.9533	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	427.0210	0.1653	70.6048	(261)
Space heating - main system 1 (low-rate cost)	106.7552	0.1388	14.8175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.5519	0.1479	144.4535	(264)
Water heating - low rate cost	418.5223	0.1241	51.9585	(264)
Space and water heating			281.8343	(265)
Pumps, fans and electric keep-hot	30.1383	0.1432	4.1819	(267)
Energy for lighting	213.1046	0.1490	31.7568	(268)
Total CO2, kg/year			317.7730	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	427.0210	1.2928	690.0917	(275)
Space heating - main system 1 (low-rate cost)	106.7552	1.5030	160.4527	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	976.5519	1.5529	1516.5200	(278)
Water heating - low rate cost	418.5223	1.4443	604.4631	(278)
Space and water heating			2971.5275	(279)
Pumps, fans and electric keep-hot	30.1383	1.5335	45.5979	(281)
Energy for lighting	213.1046	1.5547	331.3232	(282)
Total Primary energy kWh/year			3348.4485	(286)

SAP 10 EPC IMPROVEMENTS

2B4P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 95	-46 kg (14.6%)
U Solar photovoltaic panels	+ 9.5	-£ 326	-265 kg (97.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£95	0.59 kg/m²	B 83	A 97
Solar photovoltaic panels	£326	3.35 kg/m²	A 93	A 99
Total Savings	£421	3.94 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£588	£493	£95
Space heating	£160	£183	-£24
Water heating	£365	£247	£119
Lighting	£63	£63	£0
Generated (PV)	-£0	-£326	£326
Total cost of fuels	£588	£167	£421
Total cost of uses	£588	£167	£421
Delivered energy	27 kWh/m²	-3 kWh/m²	30 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	4 kg/m²
Primary energy	42 kWh/m²	12 kWh/m²	30 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000	(1b)	x 2.4000	(2b) =	94.8000	(1b) - (3b)
First floor	39.5000	(1c)	x 2.6000	(2c) =	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		197.5000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12636.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.9592 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.4000	0.0980	0.9212
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0450	0.5287
E4 Jamb	42.0000	0.0510	2.1420

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.7607 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	49.7009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	(38)
Heat transfer coeff	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	(39)
Average = Sum(39)m / 12 =												82.2884	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	(40)
HLP (average)												1.0416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4436	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)

Hot water usage for baths

28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)

Hot water usage for other uses

39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)

Average daily hot water use (litres/day)	122.2605 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)										Total = Sum(45)m =		2030.7208	

Distribution loss (46)m = 0.15 x (45)m

31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)

Water storage loss:	
Store volume	210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss
22.2642 20.1096 22.2642 21.5460 22.2642 21.5460 22.2642 22.2642 21.5460 22.2642 21.5460 22.2642 (56)
If cylinder contains dedicated solar storage
22.2642 20.1096 22.2642 21.5460 22.2642 21.5460 22.2642 22.2642 21.5460 22.2642 21.5460 22.2642 (57)
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
256.1718 226.4722 238.8721 203.5579 190.4726 169.8861 166.5257 174.9111 184.0307 210.6535 226.4958 253.2380 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Aperture area of solar collector 3.0000 (H1)
Zero-loss collector efficiency 0.8000 (H2)
Collector linear heat loss coefficient 1.8000 (H3)
Collector 2nd order heat loss coefficient 0.0000 (H4)
Collector loop efficiency 0.9000 (H5)
Incidence angle modifier 1.0000 (H6)
Overshading factor 0.8000 (H8)
Overall heat loss coefficient of system 6.5000 (H10)
Heat loss coefficient of collector loop 3.9667 (H11)
Dedicated solar storage volume 75.0000 (H12)
Effective solar volume 75.0000 (H14)
Reference volume 225.0000 (H15)
Storage tank correction coefficient 1.3161 (H16)
Heat delivered to hot water 612.2614 (H24)
Heat delivered to space heating 0.0000 (H29)
Solar input 612.2614
Solar input -0.0000 -16.2220 -57.9238 -79.1867 -102.7303 -94.4785 -93.6519 -82.2835 -57.1741 -28.6105 -0.0000 -0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
256.1718 210.2502 180.9483 124.3712 87.7423 75.4076 72.8738 92.6276 126.8566 182.0430 226.4958 253.2380 (64)
Total per year (kWh/year) = Sum(64)m = 1889.0260 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
106.4608 94.5260 100.0561 85.1228 78.6345 71.1906 70.5634 73.7865 79.2615 90.6735 95.9070 105.4853 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.1672	26.7942	21.7905	16.4968	12.3316	10.4108	11.2493	14.6222	19.6259	24.9196	29.0849	31.0056	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)													
	143.0925	140.6637	134.4841	118.2261	105.6915	98.8758	94.8432	99.1755	110.0854	121.8729	133.2041	141.7813	(72)
Total internal gains													
	598.6221	596.1864	576.5206	536.9108	497.4158	467.2551	449.7482	454.0873	478.4834	513.6228	551.9144	583.8366	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	10.6334	0.3900	0.0000	0.7700	19.2870	(74)
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	115.6008	225.2688	372.9165	553.1343	690.1155	712.8054	675.9484	571.7425	436.1776	267.4399	143.8850	95.2824	(83)
Total gains	714.2229	821.4551	949.4371	1090.0452	1187.5313	1180.0605	1125.6967	1025.8298	914.6610	781.0627	695.7994	679.1190	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	
alpha	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	
util living area													
	0.9595	0.9329	0.8732	0.7562	0.5964	0.4349	0.3188	0.3639	0.5790	0.8282	0.9363	0.9658	(86)
Living	19.6560	19.9103	20.2896	20.6656	20.8887	20.9739	20.9939	20.9898	20.9254	20.5923	20.0395	19.5826	
Non living	18.5065	18.8219	19.2828	19.7177	19.9536	20.0318	20.0461	20.0441	19.9946	19.6505	18.9887	18.4148	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3124	19.9103	20.2896	20.6656	20.8887	20.9739	20.9939	20.9898	20.9254	20.5923	20.0395	19.7808	(87)
Th 2	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	(88)
util rest of house													
	0.9519	0.9209	0.8520	0.7203	0.5465	0.3742	0.2512	0.2908	0.5115	0.7917	0.9228	0.9593	(89)
MIT 2	19.4339	18.8219	19.2828	19.7177	19.9536	20.0318	20.0461	20.0441	19.9946	19.6505	18.9887	18.7092	(90)
Living area fraction										fLA = Living area / (4) =		0.1835	(91)
MIT	19.5952	19.0216	19.4676	19.8917	20.1253	20.2047	20.2201	20.2176	20.1655	19.8233	19.1815	18.9059	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5952	19.0216	19.4676	19.8917	20.1253	20.2047	20.2201	20.2176	20.1655	19.8233	19.1815	18.9059	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9476	0.9050	0.8372	0.7139	0.5507	0.3843	0.2635	0.3040	0.5202	0.7820	0.9074	0.9493	(94)
Useful gains	676.8204	743.4502	794.8246	778.1868	653.9372	453.5283	296.5659	311.8342	475.7759	610.8042	631.3878	644.6719	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1258.6145	1162.0465	1067.0812	904.4857	693.3007	461.2001	297.8901	314.1476	499.1184	758.9727	994.1707	1210.1261	(97)
Space heating kWh	432.8548	281.2967	202.5589	90.9352	29.2864	0.0000	0.0000	0.0000	0.0000	110.2374	261.2037	420.6979	(98a)
Space heating requirement - total per year (kWh/year)												1829.0711	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	432.8548	281.2967	202.5589	90.9352	29.2864	0.0000	0.0000	0.0000	0.0000	110.2374	261.2037	420.6979	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1829.0711	
Space heating per m2											(98c) / (4) =	23.1528	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.0949	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	432.8548	281.2967	202.5589	90.9352	29.2864	0.0000	0.0000	0.0000	0.0000	110.2374	261.2037	420.6979	(98)
Space heating efficiency (main heating system 1)	266.0949	266.0949	266.0949	266.0949	266.0949	0.0000	0.0000	0.0000	0.0000	266.0949	266.0949	266.0949	(210)
Space heating fuel (main heating system)	162.6693	105.7129	76.1228	34.1740	11.0060	0.0000	0.0000	0.0000	0.0000	41.4278	98.1619	158.1007	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	256.1718	210.2502	180.9483	124.3712	87.7423	75.4076	72.8738	92.6276	126.8566	182.0430	226.4958	253.2380	(64)
Efficiency of water heater												183.9873	(216)
(217)m	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	(217)
Fuel for water heating, kWh/month	139.2334	114.2743	98.3482	67.5977	47.6893	40.9852	39.6080	50.3445	68.9485	98.9432	123.1040	137.6388	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.3542	8.4490	9.3542	9.0525	9.3542	9.0525	9.3542	9.3542	9.0525	9.3542	9.0525	9.3542	(231)
Lighting	26.4051	21.1832	19.0731	13.9738	10.7937	8.8186	9.8464	12.7987	16.6243	21.8120	24.6366	27.1390	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.7354	-53.5800	-78.4468	-87.9351	-93.1008	-86.0134	-84.8303	-80.3784	-71.8483	-60.9653	-40.7646	-31.4507	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-13.3511	-30.0000	-63.8994	-102.8369	-142.5820	-145.7003	-143.8212	-119.3956	-84.6148	-45.8806	-18.6452	-10.4631	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	687.3755	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.9873	
Water heating fuel used	1026.7152	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 4.6280, total flow = 37.0000, SFP = 0.1251)		
mechanical ventilation fans (SFP = 0.1251)	30.1383	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	110.1383	(231)
Electricity for lighting (calculated in Appendix L)	213.1046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	310.0942	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	549.9004	17.5600	107.7805	(240)
Space heating - main system 1 (low-rate cost)	137.4751	0.0940	12.9227	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	718.7007	19.6000	140.8653	(245)
Low-rate cost	308.0146	9.4000	28.9534	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)

Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	30.1383	18.5800	5.0156	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	213.1046	18.5800	39.5948	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-806.0491	18.5800	-149.7639	
PV Unit electricity exported	-921.1903	5.5900	-51.4945	
Total			-201.2585	(252)
Total energy cost			155.7378	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4521	(257)
SAP value		92.6708	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	549.9004	0.1643	90.3567	(261)
Space heating - main system 1 (low-rate cost)	137.4751	0.1379	18.9640	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	718.7007	0.1531	110.0545	(264)
Water heating - low rate cost	308.0146	0.1285	39.5886	(264)
Space and water heating			258.9638	(265)
Pumps, fans and electric keep-hot	110.1383	0.1432	15.6381	(267)
Energy for lighting	213.1046	0.1490	31.7568	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-806.0491	0.1390	-112.0151	
PV Unit electricity exported	-921.1903	0.1240	-114.2573	
Total			-226.2724	(269)
Total CO2, kg/year			80.0863	(272)
CO2 emissions per m2			1.0100	(273)
EI value			99.1346	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.5000	(1b) x	2.4000	(2b) =	94.8000	(1b) - (3b)
First floor	39.5000	(1c) x	2.6000	(2c) =	102.7000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		197.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.3700	0.6998	15.6555			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	89.0000	24.3300	64.6700	0.1800	11.6406	60.0000	3880.2000	(29a)
External Roof 1	39.5000		39.5000	0.0900	3.5550	9.0000	355.5000	(30)
Total net area of external elements Aum(A, m2)			168.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.9401			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			159.1200			9.0000	1432.0800	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			39.5000			9.0000	355.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12636.7800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		159.9592 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.4000	0.0980	0.9212
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	12.6800	0.0500	0.6340
E3 Sill	11.7500	0.0450	0.5287
E4 Jamb	42.0000	0.0510	2.1420

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.7607 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	49.7009 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	32.5875	(38)
Heat transfer coeff	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	82.2884	(39)
Average = Sum(39)m / 12 =												82.2884	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	1.0416	(40)
HLP (average)												1.0416	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4436	(42)
Hot water usage for mixer showers	65.1911	64.2114	62.7838	60.0523	58.0365	55.7886	54.5108	55.9276	57.4807	59.8943	62.6845	64.9413	(42a)
Hot water usage for baths	28.1575	27.7393	27.1505	26.0647	25.2516	24.3501	23.8631	24.4479	25.0846	26.0493	27.1574	28.0623	(42b)
Hot water usage for other uses	39.6550	38.2130	36.7710	35.3290	33.8870	32.4450	32.4450	33.8870	35.3290	36.7710	38.2130	39.6550	(42c)
Average daily hot water use (litres/day)												122.2605	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	133.0036	130.1637	126.7052	121.4460	117.1752	112.5837	110.8190	114.2626	117.8944	122.7147	128.0550	132.6587	(44)
Energy conte	210.6452	185.3514	194.7412	166.2535	157.7403	138.4348	134.0260	141.4810	145.3756	166.5226	182.4378	207.7114	(45)
Energy content (annual)										Total = Sum(45)m =		2030.7208	
Distribution loss (46)m = 0.15 x (45)m	31.5968	27.8027	29.2112	24.9380	23.6611	20.7652	20.1039	21.2221	21.8063	24.9784	27.3657	31.1567	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	256.1718	226.4722	238.8721	203.5579	190.4726	169.8861	166.5257	174.9111	184.0307	210.6535	226.4958	253.2380	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												768.8142	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												768.8142	
Solar input	-6.4558	-23.9488	-69.2895	-94.7475	-115.6547	-113.5753	-112.8903	-101.8682	-75.1942	-44.4649	-10.7250	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	249.7160	202.5234	169.5826	108.8104	74.8179	56.3108	53.6353	73.0429	108.8365	166.1886	215.7707	253.2380	(64)
										Total per year (kWh/year) = Sum(64)m =		1732.4732	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	106.4608	94.5260	100.0561	85.1228	78.6345	71.1906	70.5634	73.7865	79.2615	90.6735	95.9070	105.4853 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	30.1672	26.7942	21.7905	16.4968	12.3316	10.4108	11.2493	14.6222	19.6259	24.9196	29.0849	31.0056	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)

Water heating gains (Table 5)

	143.0925	140.6637	134.4841	118.2261	105.6915	98.8758	94.8432	99.1755	110.0854	121.8729	133.2041	141.7813	(72)

Total internal gains

	598.6221	596.1864	576.5206	536.9108	497.4158	467.2551	449.7482	454.0873	478.4834	513.6228	551.9144	583.8366	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.0400	14.2607	0.3900	0.0000	0.7700	25.8662	(74)
East	9.2900	26.6540	0.3900	0.0000	0.7700	74.3591	(76)
West	7.0400	26.6540	0.3900	0.0000	0.7700	56.3496	(80)

Solar gains	156.5749	257.9264	421.4859	639.7947	768.6398	848.2858	808.0782	687.0167	528.6510	326.7011	187.8339	128.6057	(83)
Total gains	755.1969	854.1128	998.0066	1176.7055	1266.0556	1315.5410	1257.8264	1141.1040	1007.1343	840.3238	739.7483	712.4423	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	42.6575	
alpha	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	3.8438	
util living area	0.9430	0.9146	0.8364	0.6834	0.4989	0.3223	0.2154	0.2372	0.4522	0.7407	0.9008	0.9500	(86)
Living	19.8689	20.0678	20.4451	20.7869	20.9479	20.9925	20.9989	20.9984	20.9734	20.7695	20.2933	19.8320	
Non living	18.7729	19.0159	19.4666	19.8483	20.0087	20.0448	20.0485	20.0484	20.0329	19.8432	19.2987	18.7284	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4214	20.0678	20.4451	20.7869	20.9479	20.9925	20.9989	20.9984	20.9734	20.7695	20.2933	19.9954	(87)
Th 2	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	20.0488	(88)
util rest of house	0.9322	0.8994	0.8099	0.6416	0.4455	0.2646	0.1536	0.1692	0.3817	0.6905	0.8796	0.9401	(89)
MIT 2	19.5401	19.0159	19.4666	19.8483	20.0087	20.0448	20.0485	20.0484	20.0329	19.8432	19.2987	18.9663	(90)
Living area fraction									fLA = Living area / (4) =			0.1835	(91)
MIT	19.7019	19.2090	19.6462	20.0205	20.1811	20.2188	20.2229	20.2227	20.2055	20.0132	19.4813	19.1552	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7019	19.2090	19.6462	20.0205	20.1811	20.2188	20.2229	20.2227	20.2055	20.0132	19.4813	19.1552	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9277	0.8833	0.7974	0.6403	0.4531	0.2750	0.1649	0.1817	0.3936	0.6884	0.8646	0.9286	(94)
Useful gains	700.5709	754.4503	795.7869	753.4822	573.6458	361.7325	207.4364	207.3482	396.3807	578.4933	639.5822	661.6073	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1185.1086	1111.6335	1007.7177	832.8029	590.9211	363.6134	207.6069	207.5910	403.6678	659.3959	903.6304	1123.6660	(97)
Space heating kWh	360.4960	240.0271	157.6766	57.1109	12.8528	0.0000	0.0000	0.0000	0.0000	60.1915	190.1147	343.7717	(98a)
Space heating requirement - total per year (kWh/year)												1422.2413	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	360.4960	240.0271	157.6766	57.1109	12.8528	0.0000	0.0000	0.0000	0.0000	60.1915	190.1147	343.7717	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1422.2413	
Space heating per m2											(98c) / (4) =	18.0031	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.0949	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	360.4960	240.0271	157.6766	57.1109	12.8528	0.0000	0.0000	0.0000	0.0000	60.1915	190.1147	343.7717	(98)
Space heating efficiency (main heating system 1)	266.0949	266.0949	266.0949	266.0949	266.0949	0.0000	0.0000	0.0000	0.0000	266.0949	266.0949	266.0949	(210)
Space heating fuel (main heating system)	135.4765	90.2036	59.2558	21.4626	4.8302	0.0000	0.0000	0.0000	0.0000	22.6203	71.4462	129.1914	(211)

Space heating efficiency (main heating system 2)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
249.7160	202.5234	169.5826	108.8104	74.8179	56.3108	53.6353	73.0429	108.8365	166.1886	215.7707	253.2380	(64)
Efficiency of water heater											183.9873	(216)
(217)m 183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	183.9873	(217)
Fuel for water heating, kWh/month												
135.7246	110.0746	92.1708	59.1402	40.6647	30.6058	29.1516	39.7000	59.1544	90.3261	117.2748	137.6388	(219)
Space cooling fuel requirement												
(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa 9.3542	8.4490	9.3542	9.0525	9.3542	9.0525	9.3542	9.3542	9.0525	9.3542	9.0525	9.3542	(231)
Lighting 26.4051	21.1832	19.0731	13.9738	10.7937	8.8186	9.8464	12.7987	16.6243	21.8120	24.6366	27.1390	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m -46.1615	-58.1185	-83.1723	-93.0662	-96.1704	-91.4649	-90.3213	-86.4524	-78.7688	-67.9100	-49.0048	-39.5880	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m -20.5083	-35.9032	-75.0879	-124.6588	-163.6381	-181.8793	-180.4539	-150.7142	-107.9682	-60.3564	-27.2014	-16.0221	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	534.4865	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.9873	
Water heating fuel used	941.6264	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 4.6280, total flow = 37.0000, SFP = 0.1251)		
mechanical ventilation fans (SFP = 0.1251)	30.1383	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	110.1383	(231)
Electricity for lighting (calculated in Appendix L)	213.1046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2024.5910	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-225.2352	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	427.5892	27.8600	133.4078	(240)
Space heating - main system 1 (low-rate cost)	106.8973	0.1450	15.5001	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	659.1385	31.2000	205.6512	(245)
Low-rate cost	282.4879	14.5000	40.9607	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	30.1383	29.5300	7.9435	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	213.1046	29.5300	62.9298	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-880.1992	29.5300	-259.9228	
PV Unit electricity exported	-1144.3918	5.8100	-66.4892	
Total			-326.4120	(252)
Total energy cost			166.6052	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	427.5892	0.1653	70.6894	(261)
Space heating - main system 1 (low-rate cost)	106.8973	0.1388	14.8353	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	659.1385	0.1545	101.8492	(264)
Water heating - low rate cost	282.4879	0.1297	36.6384	(264)
Space and water heating			224.0122	(265)
Pumps, fans and electric keep-hot	110.1383	0.1432	15.6381	(267)
Energy for lighting	213.1046	0.1490	31.7568	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-880.1992	0.1395	-122.7805	
PV Unit electricity exported	-1144.3918	0.1241	-142.0202	
Total			-264.8007	(269)
Total CO2, kg/year			6.6064	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	427.5892	1.2928	690.9764	(275)
Space heating - main system 1 (low-rate cost)	106.8973	1.5029	160.6584	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	659.1385	1.5768	1039.3569	(278)
Water heating - low rate cost	282.4879	1.4666	414.2831	(278)
Space and water heating			2305.2749	(279)
Pumps, fans and electric keep-hot	110.1383	1.5335	168.2767	(281)
Energy for lighting	213.1046	1.5547	331.3232	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-880.1992	1.5199	-1337.8496	
PV Unit electricity exported	-1144.3918	0.4554	-521.1013	
Total			-1858.9509	(283)
Total Primary energy kWh/year			945.9239	(286)

Full SAP Calculation Printout

Property Reference	HT5 Havant	**Issued on Date**	22/06/2025
Assessment Reference	3B5P ASHP	**Prop Type Ref**	3B5P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.13	**TER**	10.38
Environmental	96 A	**% DER < TER**			60.21
CO_2 Emissions (t/year)	0.35	**DFEE**	32.68	**TFEE**	35.72
Compliance Check	See BREL	**% DFEE < TFEE**			8.50
% DPER < TPER	19.80	**DPER**	43.32	**TPER**	54.02

Assessor Details	Mrs. Rebecca Lennon	**Assessor ID**	P627-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000 (1b)	x	2.4000 (2b)	=	111.6000	(1b) - (3b)
First floor	46.5000 (1c)	x	2.6000 (2c)	=	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	232.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14199.4200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	152.6819	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.9149 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.3728 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	(38)
Heat transfer coeff	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	(39)

Average = Sum(39)m / 12 = 90.7353

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	(40)
HLP (average)												0.9756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers

68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day) 129.2112 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)											Total = Sum(45)m =	2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
										Total per year (kWh/year) = Sum(64)m =		2682.2108	(64)
12Total per year (kWh/year)												2682	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	110.4428	98.0297	104.8539	93.6684	91.8517	83.8928	83.5184	86.1382	86.3319	94.9380	99.3557	109.4119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	123.9106	137.1868	123.9106	128.0410	123.9106	128.0410	123.9106	123.9106	128.0410	123.9106	128.0410	123.9106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)	148.4446	145.8776	140.9327	130.0950	123.4565	116.5177	112.2560	115.7771	119.9054	127.6048	137.9940	147.0589	(72)
Total internal gains	579.8142	593.0603	568.4460	548.1281	520.1786	501.2226	482.0429	483.0270	497.6790	514.8585	546.5589	567.6410	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	696.1670	820.0353	943.6512	1102.1021	1208.0229	1209.9895	1154.8675	1054.4846	935.8545	784.2852	691.4506	663.4830	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	
alpha	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	
util living area	0.9733	0.9509	0.9037	0.7943	0.6357	0.4653	0.3421	0.3893	0.6153	0.8622	0.9542	0.9776	(86)
Living	19.5382	19.8115	20.1922	20.6117	20.8675	20.9690	20.9927	20.9880	20.9123	20.5333	19.9504	19.4717	
Non living	18.4022	18.7445	19.2139	19.7091	19.9866	20.0825	20.1003	20.0977	20.0371	19.6334	18.9238	18.3183	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2522	19.8115	20.1922	20.6117	20.8675	20.9690	20.9927	20.9880	20.9123	20.5333	19.9504	19.6855	(87)
Th 2	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	(88)
util rest of house	0.9683	0.9421	0.8870	0.7625	0.5879	0.4049	0.2740	0.3162	0.5503	0.8317	0.9444	0.9733	(89)
MIT 2	19.4253	18.7445	19.2139	19.7091	19.9866	20.0825	20.1003	20.0977	20.0371	19.6334	18.9238	18.6401	(90)
Living area fraction										fLA = Living area / (4) =		0.1796	(91)
MIT	19.5738	18.9361	19.3896	19.8712	20.1448	20.2417	20.2605	20.2576	20.1943	19.7950	19.1081	18.8278	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5738	18.9361	19.3896	19.8712	20.1448	20.2417	20.2605	20.2576	20.1943	19.7950	19.1081	18.8278	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9648	0.9276	0.8714	0.7535	0.5902	0.4144	0.2860	0.3289	0.5572	0.8197	0.9304	0.9653	(94)
Useful gains	671.6611	760.6622	822.2691	830.4368	713.0012	501.4200	330.2979	346.8276	521.4780	642.8612	643.3404	640.4736	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1385.8739	1273.5665	1169.5420	995.4733	766.2415	511.9038	332.1402	350.0186	552.9665	834.3136	1089.5622	1327.2562	(97)
Space heating kWh	531.3743	344.6717	258.3710	118.8263	39.6107	0.0000	0.0000	0.0000	0.0000	142.4406	321.2797	510.9662	(98a)
Space heating requirement - total per year (kWh/year)												2267.5406	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	531.3743	344.6717	258.3710	118.8263	39.6107	0.0000	0.0000	0.0000	0.0000	142.4406	321.2797	510.9662	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2267.5406	
Space heating per m2											(98c) / (4) =	24.3822	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												263.3346	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	531.3743	344.6717	258.3710	118.8263	39.6107	0.0000	0.0000	0.0000	0.0000	142.4406	321.2797	510.9662	(98)
Space heating efficiency (main heating system 1)	263.3346	263.3346	263.3346	263.3346	263.3346	0.0000	0.0000	0.0000	0.0000	263.3346	263.3346	263.3346	(210)
Space heating fuel (main heating system)	201.7867	130.8873	98.1151	45.1237	15.0420	0.0000	0.0000	0.0000	0.0000	54.0911	122.0044	194.0368	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
Efficiency of water heater												183.5067	(216)
(217)m	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	(217)
Fuel for water heating, kWh/month	146.1242	129.1559	136.9645	119.7575	115.6549	103.7362	101.9974	106.2910	107.7337	120.7131	129.0786	144.4346	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.8942	2.6141	2.8942	2.8009	2.8942	2.8009	2.8942	2.8942	2.8009	2.8942	2.8009	2.8942	(231)
Lighting	30.8364	24.7381	22.2739	16.3188	12.6051	10.2985	11.4988	14.9466	19.4142	25.4724	28.7711	31.6934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												861.0871	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.5067	
Water heating fuel used												1461.6417	(219)

Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	34.0771	(230a)
Total electricity for the above, kWh/year	34.0771	(231)
Electricity for lighting (calculated in Appendix L)	248.8674	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2605.6733	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	688.8697	0.1641	113.0620	(261)
Space heating - main system 1 (low-rate cost)	172.2174	0.1378	23.7291	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1023.1492	0.1479	151.3739	(264)
Water heating - low rate cost	438.4925	0.1242	54.4477	(264)
Space and water heating			342.6127	(265)
Pumps, fans and electric keep-hot	34.0771	0.1432	4.7284	(267)
Energy for lighting	248.8674	0.1490	37.0862	(268)
Total CO2, kg/year			384.4273	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1300	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	688.8697	1.2894	1110.2577	(275)
Space heating - main system 1 (low-rate cost)	172.2174	1.4990	258.1472	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1023.1492	1.5530	1588.9829	(278)
Water heating - low rate cost	438.4925	1.4444	633.3457	(278)
Space and water heating			3590.7336	(279)
Pumps, fans and electric keep-hot	34.0771	1.5335	51.5572	(281)
Energy for lighting	248.8674	1.5547	386.9253	(282)
Total Primary energy kWh/year			4029.2161	(286)
Dwelling Primary energy Rate (DPER)			43.3200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000 (1b)	x	2.4000 (2b)	=	111.6000	(1b) - (3b)
First floor	46.5000 (1c)	x	2.6000 (2c)	=	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	232.5000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1290	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3790	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3222	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													

	0.4108	0.4027	0.3947	0.3544	0.3463	0.3061	0.3061	0.2980	0.3222	0.3463	0.3624	0.3786	(22b)
Effective ac	0.5844	0.5811	0.5779	0.5628	0.5600	0.5468	0.5468	0.5444	0.5519	0.5600	0.5657	0.5717	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			21.2900	1.1450	24.3779			(27)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	97.0000	23.2500	73.7500	0.1800	13.2750			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7729			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 152.6819 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	10.6000	0.0600	0.6360	
E12 Gable (insulation at ceiling level)	8.7000	0.0600	0.5220	
P1 Party wall - Ground floor	8.7000	0.0800	0.6960	
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.1200	1.0440	
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190	
E3 Sill	11.4500	0.0500	0.5725	
E4 Jamb	38.0000	0.0500	1.9000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.9895 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 56.7624 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8357	44.5843	44.3379	43.1807	42.9642	41.9562	41.9562	41.7696	42.3445	42.9642	43.4022	43.8601	(38)
Heat transfer coeff	101.5980	101.3467	101.1003	99.9430	99.7265	98.7186	98.7186	98.5319	99.1068	99.7265	100.1645	100.6225	(39)
Average = Sum(39)m / 12 =												99.9420	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0925	1.0897	1.0871	1.0747	1.0723	1.0615	1.0615	1.0595	1.0657	1.0723	1.0770	1.0820	(40)
HLP (average)												1.0746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6646 (42)

Hot water usage for mixer showers												
68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths												
29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses												
41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.3677	242.6279	257.5591	225.7825	218.4545	196.3822	193.3921	201.2711	203.7180	227.7366	242.8873	271.2671	(62)
WWHRS	-31.4965	-27.8558	-29.1690	-24.1531	-22.5098	-19.2618	-18.0548	-19.1995	-19.9290	-23.4941	-26.6159	-30.9132	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	242.8712	214.7721	228.3901	201.6295	195.9447	177.1204	175.3373	182.0716	183.7890	204.2426	216.2714	240.3539	(64)
										Total per year (kWh/year) = Sum(64)m =		2462.7938	(64)
12Total per year (kWh/year)												2463	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.4188	102.5242	109.8299	98.4838	96.8277	88.7082	88.4944	91.1142	91.1474	99.9140	104.1712	114.3879	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	155.1328	152.5658	147.6209	136.7831	130.1447	123.2059	118.9441	122.4653	126.5936	134.2930	144.6822	153.7471	(72)
Total internal gains													
	588.9088	602.0914	577.5407	557.2030	529.2732	507.2974	488.1376	489.1217	503.7538	523.9531	555.6337	576.7356	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.3200	10.6334	0.6300	0.7000	0.7700	14.0387	(74)
East	7.3600	19.6403	0.6300	0.7000	0.7700	44.1771	(76)
West	9.6100	19.6403	0.6300	0.7000	0.7700	57.6823	(80)

Solar gains	115.8981	226.0872	373.7390	551.8147	685.1706	706.0157	670.2113	569.2327	436.4647	268.3731	144.3252	95.4676	(83)
Total gains	704.8069	828.1786	951.2796	1109.0177	1214.4439	1213.3131	1158.3488	1058.3544	940.2185	792.3262	699.9590	672.2032	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.8224	38.9187	39.0136	39.4653	39.5510	39.9548	39.9548	40.0305	39.7983	39.5510	39.3780	39.1988	
alpha	3.5882	3.5946	3.6009	3.6310	3.6367	3.6637	3.6637	3.6687	3.6532	3.6367	3.6252	3.6133	
util living area													
	0.9746	0.9550	0.9143	0.8166	0.6688	0.4967	0.3685	0.4171	0.6471	0.8757	0.9571	0.9782	(86)
MIT	19.2928	19.5775	19.9906	20.4842	20.8041	20.9504	20.9871	20.9799	20.8716	20.4164	19.7737	19.2488	(87)
Th 2	20.0070	20.0092	20.0114	20.0216	20.0235	20.0324	20.0324	20.0341	20.0290	20.0235	20.0196	20.0156	(88)
util rest of house													
	0.9695	0.9464	0.8982	0.7849	0.6181	0.4293	0.2902	0.3341	0.5776	0.8457	0.9475	0.9738	(89)
MIT 2	18.0275	18.3865	18.9001	19.4963	19.8502	19.9988	20.0266	20.0243	19.9316	19.4353	18.6453	17.9776	(90)
Living area fraction									fLA = Living area / (4) =			0.1796	(91)
MIT	18.2547	18.6003	19.0959	19.6737	20.0215	20.1697	20.1991	20.1959	20.1004	19.6115	18.8479	18.2059	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2547	18.6003	19.0959	19.6737	20.0215	20.1697	20.1991	20.1959	20.1004	19.6115	18.8479	18.2059	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9573	0.9306	0.8802	0.7723	0.6180	0.4392	0.3039	0.3483	0.5830	0.8308	0.9322	0.9627	(94)
Useful gains	674.7221	770.6666	837.3018	856.5423	750.4934	532.8584	352.0376	368.6493	548.1619	658.2489	652.5308	647.1501	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1417.7693	1388.4842	1273.4503	1076.7522	829.8748	549.8287	355.2950	374.0149	594.6783	898.6826	1176.7240	1409.3059	(97)
Space heating kWh													
	552.8271	415.1734	324.4945	158.5511	59.0598	0.0000	0.0000	0.0000	0.0000	178.8827	377.4191	567.0439	(98a)
Space heating requirement - total per year (kWh/year)												2633.4515	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	552.8271	415.1734	324.4945	158.5511	59.0598	0.0000	0.0000	0.0000	0.0000	178.8827	377.4191	567.0439	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2633.4515	
Space heating per m2											(98c) / (4) =	28.3167	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	552.8271	415.1734	324.4945	158.5511	59.0598	0.0000	0.0000	0.0000	0.0000	178.8827	377.4191	567.0439	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	598.9459	449.8087	351.5650	171.7780	63.9868	0.0000	0.0000	0.0000	0.0000	193.8057	408.9048	614.3487	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	242.8712	214.7721	228.3901	201.6295	195.9447	177.1204	175.3373	182.0716	183.7890	204.2426	216.2714	240.3539	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8448	85.5119	84.8471	83.5265	81.7182	79.8000	79.8000	79.8000	79.8000	83.7638	85.2957	85.9155	(217)
Fuel for water heating, kWh/month													
	282.9188	251.1604	269.1785	241.3957	239.7811	221.9554	219.7209	228.1599	230.3121	243.8315	253.5549	279.7562	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	25.6229	20.5556	18.5080	13.5598	10.4740	8.5573	9.5547	12.4196	16.1318	21.1658	23.9067	26.3350	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.8105	-60.0055	-85.7590	-95.8483	-102.8563	-95.8000	-94.5743	-89.4942	-80.4998	-68.2955	-46.9238	-37.0499	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-25.2746	-53.0381	-105.1881	-157.6711	-208.1983	-209.1159	-206.6940	-175.1736	-128.5914	-75.7929	-33.7238	-20.0001	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2853.1435	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2961.7255	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	206.7912	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2298.3790	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3809.2812	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2853.1435	0.2100	599.1601	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2961.7255	0.2100	621.9624	(264)
Space and water heating			1221.1225	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	206.7912	0.1443	29.8464	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-899.9170	0.1347	-121.2343	
PV Unit electricity exported	-1398.4620	0.1260	-176.1373	
Total			-297.3717	(269)
Total CO2, kg/year			965.5264	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.3800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2853.1435	1.1300	3224.0522	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2961.7255	1.1300	3346.7498	(278)
Space and water heating			6570.8020	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	206.7912	1.5338	317.1832	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-899.9170	1.4979	-1347.9853	
PV Unit electricity exported	-1398.4620	0.4623	-646.5483	
Total			-1994.5335	(283)
Total Primary energy kWh/year			5023.5525	(286)
Target Primary Energy Rate (TPER)			54.0200	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000 (1b)	x	2.4000 (2b)	=	111.6000	(1b) - (3b)
First floor	46.5000 (1c)	x	2.6000 (2c)	=	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	232.5000	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)

Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1290 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3290 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2797 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.3566	0.3496	0.3426	0.3076	0.3007	0.2657	0.2657	0.2587	0.2797	0.3007	0.3146	0.3286	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5636	0.5611	0.5587	0.5473	0.5452	0.5353	0.5353	0.5335	0.5391	0.5452	0.5495	0.5540	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14199.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.6819 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.9149 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.3728 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.2405	43.0511	42.8654	41.9933	41.8302	41.0706	41.0706	40.9300	41.3632	41.8302	42.1603	42.5053	(38)
Heat transfer coeff	95.6133	95.4239	95.2382	94.3661	94.2029	93.4434	93.4434	93.3027	93.7360	94.2029	94.5330	94.8781	(39)
Average = Sum(39)m / 12 =												94.3653	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0281	1.0261	1.0241	1.0147	1.0129	1.0048	1.0048	1.0033	1.0079	1.0129	1.0165	1.0202	(40)
HLP (average)												1.0147	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.6646 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day)	65.6912 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	71.6690	69.7029	67.5564	64.8849	62.5015	60.0247	59.5102	61.6523	63.8493	66.3929	69.0881	71.5684	(44)
Energy conte	113.5062	99.2560	103.8316	88.8241	84.1391	73.8074	71.9724	76.3385	78.7326	90.0945	98.4286	112.0589	(45)
Energy content (annual)										Total = Sum(45)m =		1090.9899	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501	(64)

											Total per year (kWh/year) = Sum(64)m =	927.3414	(64)
12Total per year (kWh/year)												927	(64)
Electric shower(s)													
55.1745	49.1609	53.6818	51.2279	52.1892	49.7834	51.4428	52.1892	51.2279	53.6818	52.6724		55.1745	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		627.6062	(64a)
Heat gains from water heating, kWh/month													
37.9137	33.3821	35.4847	31.6821	30.9268	28.1299	28.1548	29.2692	29.5377	32.5655	34.0842		37.6061	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.9106	137.1868	123.9106	128.0410	123.9106	128.0410	123.9106	123.9106	128.0410	123.9106	128.0410	123.9106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	50.9593	49.6758	47.6945	44.0029	41.5683	39.0693	37.8425	39.3403	41.0245	43.7709	47.3391	50.5459	(72)
Total internal gains													
	482.3288	496.8585	475.2078	462.0361	438.2904	423.7742	407.6295	406.5903	418.7981	431.0246	455.9040	471.1279	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	598.6817	723.8334	850.4130	1016.0100	1126.1347	1132.5411	1080.4541	978.0478	856.9736	700.4513	600.7957	566.9699	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2525	41.3344	41.4149	41.7977	41.8701	42.2104	42.2104	42.2740	42.0787	41.8701	41.7239	41.5721	
alpha	3.7502	3.7556	3.7610	3.7865	3.7913	3.8140	3.8140	3.8183	3.8052	3.7913	3.7816	3.7715	
util living area													
	0.9841	0.9678	0.9311	0.8346	0.6827	0.5052	0.3746	0.4280	0.6691	0.9001	0.9712	0.9868	(86)
MIT	19.2667	19.5614	19.9855	20.4926	20.8146	20.9551	20.9888	20.9817	20.8731	20.3968	19.7393	19.2167	(87)
Th 2	20.0600	20.0617	20.0633	20.0711	20.0726	20.0794	20.0794	20.0806	20.0767	20.0726	20.0696	20.0665	(88)
util rest of house													
	0.9808	0.9615	0.9178	0.8054	0.6339	0.4398	0.2988	0.3469	0.6021	0.8749	0.9645	0.9842	(89)
MIT 2	18.4780	18.7694	19.1830	19.6639	19.9433	20.0553	20.0753	20.0735	20.0002	19.5898	18.9538	18.4333	(90)
Living area fraction										fLA = Living area / (4) =		0.1796	(91)
MIT	18.6196	18.9116	19.3271	19.8127	20.0998	20.2169	20.2394	20.2366	20.1570	19.7347	19.0948	18.5740	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6196	18.9116	19.3271	19.8127	20.0998	20.2169	20.2394	20.2366	20.1570	19.7347	19.0948	18.5740	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9516	0.9053	0.7964	0.6354	0.4499	0.3121	0.3610	0.6084	0.8640	0.9553	0.9783	(94)
Useful gains	583.2341	688.8126	769.8859	809.1237	715.5919	509.4952	337.2271	353.0350	521.3422	605.2161	573.9322	554.6902	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1369.1452	1337.0404	1221.6288	1029.7879	791.2831	524.8624	340.0737	357.9622	567.7579	860.5138	1133.9088	1363.7757	(97)
Space heating kWh													
	584.7178	435.6090	336.0967	158.8782	56.3143	0.0000	0.0000	0.0000	0.0000	189.9416	403.1832	601.9597	(98a)
Space heating requirement - total per year (kWh/year)												2766.7005	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	584.7178	435.6090	336.0967	158.8782	56.3143	0.0000	0.0000	0.0000	0.0000	189.9416	403.1832	601.9597	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2766.7005	
Space heating per m2											(98c) / (4) =	29.7495	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	878.3679	691.4811	709.1008	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9098	0.9464	0.9242	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	799.1446	654.3836	655.3353	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1274.3809	1215.9159	1098.6587	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	342.1702	417.7801	329.8326	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)

Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	85.5425	104.4450	82.4581	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												272.4457 (107)
Energy for space heating												29.7495 (99)
Energy for space cooling												2.9295 (108)
Total												32.6790 (109)
Fabric Energy Efficiency (DFEE)												32.7 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000 (1b)	x	2.4000 (2b)	=	111.6000 (1b) - (3b)	
First floor	46.5000 (1c)	x	2.6000 (2c)	=	120.9000 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	232.5000	(5)

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2. Ventilation rate

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		3 * 10 =	30.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		30.0000 / (5) =	0.1290	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3790	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3222	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4108	0.4027	0.3947	0.3544	0.3463	0.3061	0.3061	0.2980	0.3222	0.3463	0.3624	0.3786	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5844	0.5811	0.5779	0.5628	0.5600	0.5468	0.5468	0.5444	0.5519	0.5600	0.5657	0.5717	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			21.2900	1.1450	24.3779			(27)
Heatloss Floor 1			46.5000	0.1300	6.0450			(28a)
External Wall 1	97.0000	23.2500	73.7500	0.1800	13.2750			(29a)
External Roof 1	46.5000		46.5000	0.1100	5.1150			(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7729			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 152.6819 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0600	0.6360
E12 Gable (insulation at ceiling level)	8.7000	0.0600	0.5220
P1 Party wall - Ground floor	8.7000	0.0800	0.6960
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.1200	1.0440
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0500	0.5725
E4 Jamb	38.0000	0.0500	1.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.9895 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	56.7624 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	44.8357	44.5843	44.3379	43.1807	42.9642	41.9562	41.9562	41.7696	42.3445	42.9642	43.4022	43.8601	(38)
Heat transfer coeff	101.5980	101.3467	101.1003	99.9430	99.7265	98.7186	98.7186	98.5319	99.1068	99.7265	100.1645	100.6225	(39)
Average = Sum(39)m / 12 =												99.9420	

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	1.0925	1.0897	1.0871	1.0747	1.0723	1.0615	1.0615	1.0595	1.0657	1.0723	1.0770	1.0820	(40)
HLP (average)												1.0746	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses													
	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												65.6912	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	71.6690	69.7029	67.5564	64.8849	62.5015	60.0247	59.5102	61.6523	63.8493	66.3929	69.0881	71.5684	(44)
Energy conte	113.5062	99.2560	103.8316	88.8241	84.1391	73.8074	71.9724	76.3385	78.7326	90.0945	98.4286	112.0589	(45)
Energy content (annual)											Total = Sum(45)m =	1090.9899	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	96.4803	84.3676	88.2569	75.5005	71.5182	62.7362	61.1765	64.8877	66.9227	76.5803	83.6643	95.2501	(64)
											Total per year (kWh/year) = Sum(64)m =	927.3414	(64)
12Total per year (kWh/year)												927	(64)
Electric shower(s)													
	55.1745	49.1609	53.6818	51.2279	52.1892	49.7834	51.4428	52.1892	51.2279	53.6818	52.6724	55.1745	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												627.6062	(64a)
Heat gains from water heating, kWh/month													
	37.9137	33.3821	35.4847	31.6821	30.9268	28.1299	28.1548	29.2692	29.5377	32.5655	34.0842	37.6061	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	133.2299	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	123.3171	136.5297	123.3171	127.4277	123.3171	127.4277	123.3171	123.3171	127.4277	123.3171	127.4277	123.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	244.4900	247.0270	240.6338	227.0233	209.8424	193.6949	182.9074	180.3703	186.7636	200.3741	217.5549	233.7024	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	36.3230	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	50.9593	49.6758	47.6945	44.0029	41.5683	39.0693	37.8425	39.3403	41.0245	43.7709	47.3391	50.5459	(72)
Total internal gains													
	481.7353	496.2014	474.6143	461.4228	437.6969	423.1609	407.0360	405.9967	418.1848	430.4310	455.2907	470.5344	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.3200	10.6334	0.6300	0.7000	0.7700	14.0387	(74)
East	7.3600	19.6403	0.6300	0.7000	0.7700	44.1771	(76)
West	9.6100	19.6403	0.6300	0.7000	0.7700	57.6823	(80)

Solar gains	115.8981	226.0872	373.7390	551.8147	685.1706	706.0157	670.2113	569.2327	436.4647	268.3731	144.3252	95.4676	(83)
Total gains	597.6334	722.2886	848.3532	1013.2375	1122.8675	1129.1766	1077.2473	975.2295	854.6495	698.8042	599.6159	566.0019	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.8224	38.9187	39.0136	39.4653	39.5510	39.9548	39.9548	40.0305	39.7983	39.5510	39.3780	39.1988	
alpha	3.5882	3.5946	3.6009	3.6310	3.6367	3.6637	3.6637	3.6687	3.6532	3.6367	3.6252	3.6133	
util living area													
	0.9845	0.9695	0.9361	0.8475	0.7040	0.5281	0.3945	0.4494	0.6905	0.9076	0.9726	0.9872	(86)
MIT	19.1263	19.4242	19.8625	20.4044	20.7672	20.9394	20.9839	20.9744	20.8404	20.3151	19.6264	19.0813	(87)
Th 2	20.0070	20.0092	20.0114	20.0216	20.0235	20.0324	20.0324	20.0341	20.0290	20.0235	20.0196	20.0156	(88)
util rest of house													
	0.9814	0.9634	0.9232	0.8188	0.6540	0.4581	0.3114	0.3612	0.6213	0.8831	0.9660	0.9845	(89)
MIT 2	18.3006	18.5958	19.0247	19.5427	19.8608	20.0000	20.0267	20.0242	19.9326	19.4751	18.8061	18.2622	(90)
Living area fraction										fLA = Living area / (4) =		0.1796	(91)
MIT	18.4489	18.7445	19.1752	19.6975	20.0235	20.1687	20.1986	20.1948	20.0956	19.6259	18.9534	18.4093	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4489	18.7445	19.1752	19.6975	20.0235	20.1687	20.1986	20.1948	20.0956	19.6259	18.9534	18.4093	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9532	0.9100	0.8081	0.6540	0.4683	0.3260	0.3763	0.6264	0.8711	0.9566	0.9785	(94)
Useful gains	582.3879	688.4739	771.9734	818.7513	734.3539	528.8182	351.1317	366.9866	535.3652	608.7036	573.5694	553.8154	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1437.4982	1403.0959	1281.4626	1079.1315	830.0785	549.7360	355.2443	373.9098	594.2018	900.1218	1187.2896	1429.7762	(97)
Space heating kWh	636.2020	480.2260	379.0599	187.4738	71.2191	0.0000	0.0000	0.0000	0.0000	216.8151	441.8785	651.7148	(98a)
Space heating requirement - total per year (kWh/year)												3064.5893	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	636.2020	480.2260	379.0599	187.4738	71.2191	0.0000	0.0000	0.0000	0.0000	216.8151	441.8785	651.7148	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3064.5893	
Space heating per m2											(98c) / (4) =	32.9526	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	927.9547	730.5175	748.8427	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8892	0.9315	0.9058	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	825.1614	680.4636	678.2749	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1271.1132	1212.8053	1095.9853	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	321.0853	396.0622	310.7765	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	80.2713	99.0156	77.6941	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												256.9810	(107)
Energy for space heating												32.9526	(99)
Energy for space cooling												2.7632	(108)
Total												35.7158	(109)
Fabric Energy Efficiency (TFEE)												35.7	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area		Storey height		Volume	
	(m2)		(m)		(m3)	
Main dwelling						
Ground floor	46.5000	(1b)	x 2.4000	(2b) =	111.6000	(1b) - (3b)
First floor	46.5000	(1c)	x 2.6000	(2c) =	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		232.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14199.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.6819 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.9149 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.3728 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	(38)
Heat transfer coeff	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	(39)
Average = Sum(39)m / 12 =												90.7353	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	(40)
HLP (average)												0.9756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646	(42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
								Total per year (kWh/year) = Sum(64)m =				2682.2108	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000	(64a)
Heat gains from water heating, kWh/month	110.4428	98.0297	104.8539	93.6684	91.8517	83.8928	83.5184	86.1382	86.3319	94.9380	99.3557	109.4119	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.2298	31.2908	25.4474	19.2653	14.4010	12.1580	13.1371	17.0761	22.9195	29.1016	33.9658	36.2089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													

	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	148.4446	145.8776	140.9327	130.0950	123.4565	116.5177	112.2560	115.7771	119.9054	127.6048	137.9940	147.0589	(72)
Total internal gains													
	655.5289	652.8095	632.4790	595.1450	557.9994	524.7167	505.3332	509.0068	528.5207	562.7163	603.6128	639.0216	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	771.8818	879.7844	1007.6842	1149.1190	1245.8437	1233.4836	1178.1578	1080.4643	966.6962	832.1430	748.5045	734.8636	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	
alpha	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	
util living area	0.9633	0.9399	0.8865	0.7773	0.6211	0.4572	0.3355	0.3804	0.6000	0.8426	0.9423	0.9690	(86)
Living	19.6532	19.8937	20.2629	20.6428	20.8778	20.9708	20.9932	20.9889	20.9196	20.5769	20.0299	19.5825	
Non living	18.5461	18.8457	19.2978	19.7429	19.9962	20.0838	20.1005	20.0982	20.0431	19.6816	19.0212	18.4575	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3110	19.8937	20.2629	20.6428	20.8778	20.9708	20.9932	20.9889	20.9196	20.5769	20.0299	19.7808	(87)
Th 2	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	(88)
util rest of house	0.9566	0.9295	0.8678	0.7444	0.5735	0.3977	0.2686	0.3088	0.5355	0.8098	0.9305	0.9633	(89)
MIT 2	19.4827	18.8457	19.2978	19.7429	19.9962	20.0838	20.1005	20.0982	20.0431	19.6816	19.0212	18.7541	(90)
Living area fraction									fLA = Living area / (4) =			0.1796	(91)
MIT	19.6315	19.0339	19.4711	19.9045	20.1546	20.2431	20.2608	20.2581	20.2005	19.8424	19.2023	18.9385	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6315	19.0339	19.4711	19.9045	20.1546	20.2431	20.2608	20.2581	20.2005	19.8424	19.2023	18.9385	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9525	0.9142	0.8526	0.7365	0.5763	0.4071	0.2805	0.3213	0.5428	0.7989	0.9156	0.9539	(94)
Useful gains	735.2507	804.2828	859.1227	846.3632	718.0390	502.1696	330.4470	347.1323	524.7342	664.8024	685.3475	700.9724	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1391.1053	1282.4420	1176.9368	998.4949	767.1261	512.0291	332.1652	350.0695	553.5306	838.6087	1098.1064	1337.3011	(97)
Space heating kWh	487.9559	321.3229	236.4537	109.5348	36.5207	0.0000	0.0000	0.0000	0.0000	129.3119	297.1864	473.4286	(98a)
Space heating requirement - total per year (kWh/year)												2091.7150	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	487.9559	321.3229	236.4537	109.5348	36.5207	0.0000	0.0000	0.0000	0.0000	129.3119	297.1864	473.4286	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2091.7150	
Space heating per m2											(98c) / (4) =	22.4916	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	263.3346	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.9559	321.3229	236.4537	109.5348	36.5207	0.0000	0.0000	0.0000	0.0000	129.3119	297.1864	473.4286	(98)
Space heating efficiency (main heating system 1)	263.3346	263.3346	263.3346	263.3346	263.3346	0.0000	0.0000	0.0000	0.0000	263.3346	263.3346	263.3346	(210)
Space heating fuel (main heating system)	185.2988	122.0208	89.7921	41.5953	13.8686	0.0000	0.0000	0.0000	0.0000	49.1056	112.8551	179.7821	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
Efficiency of water heater												183.5067	(216)
(217)m	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	(217)
Fuel for water heating, kWh/month	146.1242	129.1559	136.9645	119.7575	115.6549	103.7362	101.9974	106.2910	107.7337	120.7131	129.0786	144.4346	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)

Pumps and Fa	2.8942	2.6141	2.8942	2.8009	2.8942	2.8009	2.8942	2.8942	2.8009	2.8942	2.8009	2.8942	(231)
Lighting	30.8364	24.7381	22.2739	16.3188	12.6051	10.2985	11.4988	14.9466	19.4142	25.4724	28.7711	31.6934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	794.3182	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5067	
Water heating fuel used	1461.6417	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	34.0771	(230a)
Total electricity for the above, kWh/year	34.0771	(231)
Electricity for lighting (calculated in Appendix L)	248.8674	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2538.9044	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	635.4546	17.5600	124.5491	(240)
Space heating - main system 1 (low-rate cost)	158.8636	0.0940	14.9332	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1023.1492	19.6000	200.5372	(245)
Low-rate cost	438.4925	9.4000	41.2183	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	34.0771	18.5800	5.6711	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	248.8674	18.5800	46.2396	(250)
Additional standing charges			7.0000	(251)
Total energy cost			440.1485	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1482	(257)
SAP value		81.3875	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	635.4546	0.1642	104.3130	(261)
Space heating - main system 1 (low-rate cost)	158.8636	0.1378	21.8931	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1023.1492	0.1479	151.3739	(264)
Water heating - low rate cost	438.4925	0.1242	54.4477	(264)
Space and water heating			332.0276	(265)
Pumps, fans and electric keep-hot	34.0771	0.1432	4.7284	(267)
Energy for lighting	248.8674	0.1490	37.0862	(268)
Total CO2, kg/year			373.8422	(272)
CO2 emissions per m2			4.0200	(273)
EI value			96.3699	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000 (1b)	x	2.4000 (2b)	=	111.6000	(1b) - (3b)
First floor	46.5000 (1c)	x	2.6000 (2c)	=	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	232.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 14199.4200	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	152.6819	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.9149	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 52.3728	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	(38)
Heat transfer coeff	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	(39)
Average = Sum(39)m / 12 =												90.7353	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	(40)
HLP (average)												0.9756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6646	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)

Hot water usage for baths

29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)

Hot water usage for other uses

41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)

Average daily hot water use (litres/day)	129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)											Total = Sum(45)m =	2146.1718	
Distribution loss (46)m = 0.15 x (45)m													
	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
										Total per year (kWh/year) = Sum(64)m =		2682.2108	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	110.4428	98.0297	104.8539	93.6684	91.8517	83.8928	83.5184	86.1382	86.3319	94.9380	99.3557	109.4119	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.2298	31.2908	25.4474	19.2653	14.4010	12.1580	13.1371	17.0761	22.9195	29.1016	33.9658	36.2089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	148.4446	145.8776	140.9327	130.0950	123.4565	116.5177	112.2560	115.7771	119.9054	127.6048	137.9940	147.0589	(72)
Total internal gains													
	655.5289	652.8095	632.4790	595.1450	557.9994	524.7167	505.3332	509.0068	528.5207	562.7163	603.6128	639.0216	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	14.2607	0.3900	0.0000	0.7700	18.8857	(74)
East	7.5200	26.6540	0.3900	0.0000	0.7700	60.1916	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	157.6787	259.8706	423.7356	639.9162	765.0027	842.2931	803.1923	685.7050	530.5121	329.0180	189.2193	129.4516	(83)
Total gains	813.2076	912.6801	1056.2146	1235.0612	1323.0021	1367.0098	1308.5255	1194.7118	1059.0328	891.7343	792.8320	768.4732	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	
alpha	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	
util living area													
	0.9484	0.9234	0.8527	0.7079	0.5235	0.3416	0.2283	0.2498	0.4726	0.7594	0.9099	0.9546	(86)
Living	19.8600	20.0481	20.4182	20.7682	20.9418	20.9914	20.9987	20.9982	20.9709	20.7567	20.2796	19.8259	
Non living	18.8057	19.0371	19.4834	19.8805	20.0574	20.0989	20.1033	20.1031	20.0854	19.8809	19.3281	18.7644	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4168	20.0481	20.4182	20.7682	20.9418	20.9914	20.9987	20.9982	20.9709	20.7567	20.2796	19.9902	(87)
Th 2	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	(88)
util rest of house													
	0.9390	0.9101	0.8291	0.6689	0.4716	0.2841	0.1665	0.1824	0.4039	0.7130	0.8911	0.9460	(89)
MIT 2	19.5862	19.0371	19.4834	19.8805	20.0574	20.0989	20.1033	20.1031	20.0854	19.8809	19.3281	19.0057	(90)
Living area fraction										fLA = Living area / (4) =		0.1796	(91)
MIT	19.7354	19.2186	19.6512	20.0399	20.2163	20.2592	20.2641	20.2639	20.2444	20.0382	19.4989	19.1825	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7354	19.2186	19.6512	20.0399	20.2163	20.2592	20.2641	20.2639	20.2444	20.0382	19.4989	19.1825	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9345	0.8943	0.8157	0.6660	0.4783	0.2942	0.1776	0.1945	0.4149	0.7093	0.8760	0.9351	(94)
Useful gains	759.9557	816.2205	861.5134	822.5208	632.7495	402.1255	232.4252	232.3157	439.4044	632.4972	694.5283	718.5723	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)

Heat loss rate W

1309.7975	1226.6171	1111.6203	920.0444	654.7685	404.6070	232.6533	232.6340	448.6318	729.3441	997.9923	1241.4869	(97)

Space heating kWh

409.0823	275.7865	186.0796	70.2170	16.3821	0.0000	0.0000	0.0000	0.0000	72.0541	218.4941	389.0485	(98a)

Space heating requirement - total per year (kWh/year) 1637.1442

Solar heating kWh

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

409.0823	275.7865	186.0796	70.2170	16.3821	0.0000	0.0000	0.0000	0.0000	72.0541	218.4941	389.0485	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1637.1442

Space heating per m2 (98c) / (4) = 17.6037 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 263.3346 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	409.0823	275.7865	186.0796	70.2170	16.3821	0.0000	0.0000	0.0000	0.0000	72.0541	218.4941	389.0485	(98)
Space heating efficiency (main heating system 1)													
	263.3346	263.3346	263.3346	263.3346	263.3346	0.0000	0.0000	0.0000	0.0000	263.3346	263.3346	263.3346	(210)
Space heating fuel (main heating system)													
	155.3469	104.7285	70.6628	26.6645	6.2210	0.0000	0.0000	0.0000	0.0000	27.3622	82.9720	147.7392	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	268.1477	237.0098	251.3391	219.7632	212.2345	190.3628	187.1722	195.0511	197.6987	221.5166	236.8680	265.0471	(64)
Efficiency of water heater												183.5067	(216)
(217)m	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	(217)
Fuel for water heating, kWh/month													
	146.1242	129.1559	136.9645	119.7575	115.6549	103.7362	101.9974	106.2910	107.7337	120.7131	129.0786	144.4346	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.8942	2.6141	2.8942	2.8009	2.8942	2.8009	2.8942	2.8942	2.8009	2.8942	2.8009	2.8942	(231)
Lighting	30.8364	24.7381	22.2739	16.3188	12.6051	10.2985	11.4988	14.9466	19.4142	25.4724	28.7711	31.6934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 621.6972 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.5067

Water heating fuel used 1461.6417 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)

mechanical ventilation fans (SFP = 0.1201) 34.0771 (230a)

Total electricity for the above, kWh/year 34.0771 (231)

Electricity for lighting (calculated in Appendix L) 248.8674 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation 0.0000 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses 2366.2835 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	497.3578	27.8600	155.1756	(240)
Space heating - main system 1 (low-rate cost)	124.3394	0.1450	18.0292	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1023.1492	31.2000	319.2225	(245)
Low-rate cost	438.4925	14.5000	63.5814	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	34.0771	29.5300	8.9817	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	248.8674	29.5300	73.4906	(250)
Additional standing charges			3.0000	(251)
Total energy cost			641.4811	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	497.3578	0.1652	82.1435	(261)
Space heating - main system 1 (low-rate cost)	124.3394	0.1386	17.2391	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1023.1492	0.1479	151.3739	(264)
Water heating - low rate cost	438.4925	0.1242	54.4477	(264)
Space and water heating			305.2042	(265)
Pumps, fans and electric keep-hot	34.0771	0.1432	4.7284	(267)
Energy for lighting	248.8674	0.1490	37.0862	(268)
Total CO2, kg/year			347.0188	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	497.3578	1.2923	803.4347	(275)
Space heating - main system 1 (low-rate cost)	124.3394	1.5024	186.8062	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1023.1492	1.5530	1588.9829	(278)
Water heating - low rate cost	438.4925	1.4444	633.3457	(278)
Space and water heating			3212.5695	(279)
Pumps, fans and electric keep-hot	34.0771	1.5335	51.5572	(281)
Energy for lighting	248.8674	1.5547	386.9253	(282)
Total Primary energy kWh/year			3651.0519	(286)

SAP 10 EPC IMPROVEMENTS

3B5P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.0	-£ 97	-47 kg (13.6%)
U Solar photovoltaic panels	+ 8.7	-£ 336	-265 kg (88.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£97	0.51 kg/m²	B 83	A 97
Solar photovoltaic panels	£336	2.85 kg/m²	A 92	A 99
Total Savings	£432	3.36 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£641	£545	£97
Space heating	£185	£209	-£24
Water heating	£383	£262	£120
Lighting	£73	£73	£0
Generated (PV)	-£0	-£336	£336
Total cost of fuels	£641	£209	£433
Total cost of uses	£641	£208	£432
Delivered energy	25 kWh/m²	-0 kWh/m²	26 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	3 kg/m²
Primary energy	39 kWh/m²	13 kWh/m²	26 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000	(1b)	x 2.4000	(2b) =	111.6000	(1b) - (3b)
First floor	46.5000	(1c)	x 2.6000	(2c) =	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		232.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14199.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.6819 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.9149	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	52.3728	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	(38)
Heat transfer coeff	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	(39)
Average = Sum(39)m / 12 =												90.7353	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	(40)
HLP (average)												0.9756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6646	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)

Water storage loss:		
Store volume	210.0000	(47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss
22.2642 20.1096 22.2642 21.5460 22.2642 21.5460 22.2642 22.2642 21.5460 22.2642 21.5460 22.2642 (56)
If cylinder contains dedicated solar storage
22.2642 20.1096 22.2642 21.5460 22.2642 21.5460 22.2642 22.2642 21.5460 22.2642 21.5460 22.2642 (57)
Primary loss 23.2624 21.0112 21.8667 15.7584 10.4681 9.9053 10.2355 11.1660 17.1091 21.8667 22.5120 23.2624 (59)
Combi loss 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (61)
Total heat required for water heating calculated for each month
268.1477 237.0098 249.9433 213.0096 199.4402 177.7561 174.1452 182.9547 192.2958 220.1209 236.8680 265.0471 (62)
WWHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63a)
PV diverter -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 -0.0000 (63b)
Aperture area of solar collector 3.0000 (H1)
Zero-loss collector efficiency 0.8000 (H2)
Collector linear heat loss coefficient 1.8000 (H3)
Collector 2nd order heat loss coefficient 0.0000 (H4)
Collector loop efficiency 0.9000 (H5)
Incidence angle modifier 1.0000 (H6)
Overshading factor 0.8000 (H8)
Overall heat loss coefficient of system 6.5000 (H10)
Heat loss coefficient of collector loop 3.9667 (H11)
Dedicated solar storage volume 75.0000 (H12)
Effective solar volume 75.0000 (H14)
Reference volume 225.0000 (H15)
Storage tank correction coefficient 1.3161 (H16)
Heat delivered to hot water 618.8790 (H24)
Heat delivered to space heating 0.0000 (H29)
Solar input 618.8790
Solar input -0.0000 -16.2112 -58.2583 -79.9341 -104.1193 -95.8201 -95.0149 -83.2618 -57.6020 -28.6572 -0.0000 -0.0000 (63c)
FGHRS 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63d)
Output from w/h
268.1477 220.7986 191.6850 133.0755 95.3209 81.9360 79.1303 99.6928 134.6938 191.4637 236.8680 265.0471 (64)
Total per year (kWh/year) = Sum(64)m = 1997.8594 (64)
Electric shower(s)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month
110.4428 98.0297 103.7373 88.2655 81.6162 73.8074 73.0969 76.4610 82.0096 93.8214 99.3557 109.4119 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	35.2298	31.2908	25.4474	19.2653	14.4010	12.1580	13.1371	17.0761	22.9195	29.1016	33.9658	36.2089	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	(71)
Water heating gains (Table 5)													
	148.4446	145.8776	139.4319	122.5910	109.6992	102.5103	98.2485	102.7702	113.9022	126.1040	137.9940	147.0589	(72)
Total internal gains													
	655.5289	652.8095	630.9782	587.6410	544.2420	510.7092	491.3258	495.9999	522.5175	561.2155	603.6128	639.0216	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	771.8818	879.7844	1006.1834	1141.6150	1232.0864	1219.4761	1164.1504	1067.4574	960.6930	830.6422	748.5045	734.8636	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	
alpha	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	
util living area													
	0.9633	0.9399	0.8869	0.7800	0.6264	0.4620	0.3394	0.3848	0.6029	0.8432	0.9423	0.9690	(86)
Living	19.6532	19.8937	20.2613	20.6380	20.8742	20.9698	20.9929	20.9885	20.9183	20.5755	20.0299	19.5825	
Non living	18.5461	18.8457	19.2959	19.7377	19.9929	20.0831	20.1004	20.0980	20.0420	19.6802	19.0212	18.4575	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3110	19.8937	20.2613	20.6380	20.8742	20.9698	20.9929	20.9885	20.9183	20.5755	20.0299	19.7808	(87)
Th 2	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	(88)
util rest of house													
	0.9566	0.9295	0.8682	0.7473	0.5787	0.4020	0.2718	0.3124	0.5384	0.8105	0.9305	0.9633	(89)
MIT 2	19.4827	18.8457	19.2959	19.7377	19.9929	20.0831	20.1004	20.0980	20.0420	19.6802	19.0212	18.7541	(90)
Living area fraction									fLA = Living area / (4) =			0.1796	(91)
MIT	19.6315	19.0339	19.4693	19.8994	20.1511	20.2423	20.2607	20.2579	20.1993	19.8410	19.2023	18.9385	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6315	19.0339	19.4693	19.8994	20.1511	20.2423	20.2607	20.2579	20.1993	19.8410	19.2023	18.9385	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9525	0.9142	0.8530	0.7392	0.5813	0.4114	0.2838	0.3251	0.5456	0.7996	0.9156	0.9539	(94)
Useful gains	735.2507	804.2828	858.2917	843.9105	716.2608	501.7295	330.3589	346.9836	524.1267	664.1450	685.3475	700.9724	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1391.1053	1282.4420	1176.7707	998.0313	766.8144	511.9555	332.1504	350.0447	553.4256	838.4807	1098.1064	1337.3011	(97)
Space heating kWh	487.9559	321.3229	236.9483	110.9670	37.6119	0.0000	0.0000	0.0000	0.0000	129.7057	297.1864	473.4286	(98a)
Space heating requirement - total per year (kWh/year)												2095.1267	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	487.9559	321.3229	236.9483	110.9670	37.6119	0.0000	0.0000	0.0000	0.0000	129.7057	297.1864	473.4286	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2095.1267	
Space heating per m2											(98c) / (4) =	22.5282	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	263.3346	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	487.9559	321.3229	236.9483	110.9670	37.6119	0.0000	0.0000	0.0000	0.0000	129.7057	297.1864	473.4286	(98)
Space heating efficiency (main heating system 1)	263.3346	263.3346	263.3346	263.3346	263.3346	0.0000	0.0000	0.0000	0.0000	263.3346	263.3346	263.3346	(210)
Space heating fuel (main heating system)	185.2988	122.0208	89.9799	42.1391	14.2829	0.0000	0.0000	0.0000	0.0000	49.2551	112.8551	179.7821	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.1477	220.7986	191.6850	133.0755	95.3209	81.9360	79.1303	99.6928	134.6938	191.4637	236.8680	265.0471	(64)
Efficiency of water heater												183.5067	(216)
(217)m	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	(217)
Fuel for water heating, kWh/month	146.1242	120.3218	104.4567	72.5180	51.9441	44.6501	43.1212	54.3265	73.3999	104.3360	129.0786	144.4346	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.6887	8.7511	9.6887	9.3762	9.6887	9.3762	9.6887	9.6887	9.3762	9.6887	9.3762	9.6887	(231)
Lighting	30.8364	24.7381	22.2739	16.3188	12.6051	10.2985	11.4988	14.9466	19.4142	25.4724	28.7711	31.6934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.3405	-54.8759	-81.0967	-91.8800	-98.0557	-90.6586	-89.4037	-84.2980	-74.7551	-62.8069	-41.5749	-31.9273	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.7460	-28.7041	-61.2496	-98.8921	-137.6270	-141.0552	-139.2478	-115.4760	-81.7080	-44.0389	-17.8349	-9.9865	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	795.6138	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5067	
Water heating fuel used	1088.7118	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	34.0771	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	114.0771	(231)
Electricity for lighting (calculated in Appendix L)	248.8674	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	520.0307	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	636.4910	17.5600	124.7522	(240)
Space heating - main system 1 (low-rate cost)	159.1228	0.0940	14.9575	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	762.0982	19.6000	149.3713	(245)
Low-rate cost	326.6135	9.4000	30.7017	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)

Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	34.0771	18.5800	5.6711	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	248.8674	18.5800	46.2396	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-838.6732	18.5800	-155.8255	
PV Unit electricity exported	-888.5662	5.5900	-49.6708	
Total			-205.4963	(252)
Total energy cost			188.0611	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4906	(257)
SAP value		92.0475	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	636.4910	0.1641	104.4653	(261)
Space heating - main system 1 (low-rate cost)	159.1228	0.1378	21.9251	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	762.0982	0.1529	116.5568	(264)
Water heating - low rate cost	326.6135	0.1284	41.9275	(264)
Space and water heating			284.8746	(265)
Pumps, fans and electric keep-hot	114.0771	0.1432	16.1847	(267)
Energy for lighting	248.8674	0.1490	37.0862	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-838.6732	0.1388	-116.3900	
PV Unit electricity exported	-888.5662	0.1239	-110.1037	
Total			-226.4937	(269)
Total CO2, kg/year			111.6517	(272)
CO2 emissions per m2			1.2000	(273)
EI value			98.9158	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	46.5000	(1b) x	2.4000	(2b) =	111.6000	(1b) - (3b)
First floor	46.5000	(1c) x	2.6000	(2c) =	120.9000	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		232.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised		
If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			46.5000	0.1100	5.1150	75.0000	3487.5000	(28a)
External Wall 1	97.0000	23.7100	73.2900	0.1800	13.1922	60.0000	4397.4000	(29a)
External Roof 1	46.5000		46.5000	0.0900	4.1850	9.0000	418.5000	(30)
Total net area of external elements Aum(A, m2)			190.0000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.4578			(33)
Main dwelling								
Party Wall 1			43.5000	0.0000	0.0000	70.0000	3045.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			46.5000			18.0000	837.0000	(32d)
Internal Ceiling 1			46.5000			9.0000	418.5000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14199.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		152.6819 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.6000	0.0980	1.0388
E12 Gable (insulation at ceiling level)	8.7000	0.0970	0.8439
P1 Party wall - Ground floor	8.7000	0.3200	2.7840
P2 Party wall - Intermediate floor within a dwelling	8.7000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7000	0.4800	4.1760
E1 Steel lintel with perforated steel base plate	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.9149 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.3728 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	38.3625	(38)
Heat transfer coeff	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	90.7353	(39)
Average = Sum(39)m / 12 =												90.7353	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	0.9756	(40)
HLP (average)												0.9756	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6646	(42)
Hot water usage for mixer showers	68.8963	67.8609	66.3522	63.4655	61.3351	58.9594	57.6091	59.1064	60.7477	63.2985	66.2473	68.6323	(42a)
Hot water usage for baths	29.7509	29.3090	28.6868	27.5396	26.6806	25.7280	25.2135	25.8314	26.5041	27.5233	28.6942	29.6503	(42b)
Hot water usage for other uses	41.9181	40.3938	38.8695	37.3453	35.8210	34.2967	34.2967	35.8210	37.3453	38.8695	40.3938	41.9181	(42c)
Average daily hot water use (litres/day)												129.2112	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	140.5653	137.5638	133.9086	128.3503	123.8366	118.9841	117.1192	120.7587	124.5971	129.6914	135.3353	140.2008	(44)
Energy conte	222.6211	195.8890	205.8125	175.7052	166.7079	146.3048	141.6456	149.5245	153.6407	175.9900	192.8100	219.5205	(45)
Energy content (annual)										Total = Sum(45)m =		2146.1718	
Distribution loss (46)m = 0.15 x (45)m	33.3932	29.3834	30.8719	26.3558	25.0062	21.9457	21.2468	22.4287	23.0461	26.3985	28.9215	32.9281	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	268.1477	237.0098	249.9433	213.0096	199.4402	177.7561	174.1452	182.9547	192.2958	220.1209	236.8680	265.0471	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.8000	(H2)
Collector linear heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0000	(H4)
Collector loop efficiency	0.9000	(H5)
Incidence angle modifier	1.0000	(H6)
Overshading factor	0.8000	(H8)
Overall heat loss coefficient of system	6.5000	(H10)
Heat loss coefficient of collector loop	3.9667	(H11)
Dedicated solar storage volume	75.0000	(H12)
Effective solar volume	75.0000	(H14)
Reference volume	225.0000	(H15)
Storage tank correction coefficient	1.3161	(H16)
Heat delivered to hot water	778.3405	(H24)
Heat delivered to space heating	0.0000	(H29)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar input												778.3405	
Solar input	-6.3871	-23.9903	-69.7575	-95.7943	-117.3932	-115.5093	-114.8787	-103.3529	-75.9347	-44.6775	-10.6651	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	261.7606	213.0196	180.1859	117.2153	82.0470	62.2468	59.2665	79.6018	116.3611	175.4434	226.2028	265.0471	(64)
										Total per year (kWh/year) = Sum(64)m =		1838.3979	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)

Heat gains from water heating, kWh/month

	110.4428	98.0297	103.7373	88.2655	81.6162	73.8074	73.0969	76.4610	82.0096	93.8214	99.3557	109.4119 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	159.8758	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	35.2298	31.2908	25.4474	19.2653	14.4010	12.1580	13.1371	17.0761	22.9195	29.1016	33.9658	36.2089 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	364.9104	368.6970	359.1549	338.8407	313.1977	289.0969	272.9961	269.2094	278.7516	299.0658	324.7088	348.8096 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522	53.6522 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839	-106.5839 (71)

Water heating gains (Table 5)

	148.4446	145.8776	139.4319	122.5910	109.6992	102.5103	98.2485	102.7702	113.9022	126.1040	137.9940	147.0589 (72)

Total internal gains

	655.5289	652.8095	630.9782	587.6410	544.2420	510.7092	491.3258	495.9999	522.5175	561.2155	603.6128	639.0216 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	14.2607	0.3900	0.0000	0.7700	18.8857	(74)
East	7.5200	26.6540	0.3900	0.0000	0.7700	60.1916	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	157.6787	259.8706	423.7356	639.9162	765.0027	842.2931	803.1923	685.7050	530.5121	329.0180	189.2193	129.4516	(83)
Total gains	813.2076	912.6801	1054.7138	1227.5572	1309.2447	1353.0023	1294.5181	1181.7048	1053.0296	890.2335	792.8320	768.4732	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	43.4702	
alpha	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	3.8980	
util living area	0.9484	0.9234	0.8531	0.7107	0.5282	0.3450	0.2307	0.2525	0.4750	0.7601	0.9099	0.9546	(86)
Living	19.8600	20.0481	20.4168	20.7649	20.9400	20.9911	20.9987	20.9981	20.9704	20.7558	20.2796	19.8259	
Non living	18.8057	19.0371	19.4818	19.8771	20.0559	20.0988	20.1033	20.1031	20.0851	19.8800	19.3281	18.7644	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4168	20.0481	20.4168	20.7649	20.9400	20.9911	20.9987	20.9981	20.9704	20.7558	20.2796	19.9902	(87)
Th 2	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	20.1037	(88)
util rest of house	0.9390	0.9101	0.8296	0.6718	0.4760	0.2870	0.1683	0.1844	0.4060	0.7138	0.8911	0.9460	(89)
MIT 2	19.5862	19.0371	19.4818	19.8771	20.0559	20.0988	20.1033	20.1031	20.0851	19.8800	19.3281	19.0057	(90)
Living area fraction									fLA = Living area / (4) =			0.1796	(91)
MIT	19.7354	19.2186	19.6497	20.0365	20.2147	20.2590	20.2641	20.2638	20.2440	20.0373	19.4989	19.1825	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7354	19.2186	19.6497	20.0365	20.2147	20.2590	20.2641	20.2638	20.2440	20.0373	19.4989	19.1825	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9345	0.8943	0.8162	0.6687	0.4827	0.2971	0.1795	0.1966	0.4171	0.7100	0.8760	0.9351	(94)
Useful gains	759.9557	816.2205	860.8048	820.8387	631.9080	402.0173	232.4141	232.2999	439.2024	632.0731	694.5283	718.5723	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1309.7975	1226.6171	1111.4809	919.7376	654.6258	404.5890	232.6513	232.6312	448.5979	729.2653	997.9923	1241.4869	(97)
Space heating kWh	409.0823	275.7865	186.5030	71.2072	16.9020	0.0000	0.0000	0.0000	0.0000	72.3110	218.4941	389.0485	(98a)
Space heating requirement - total per year (kWh/year)												1639.3347	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	409.0823	275.7865	186.5030	71.2072	16.9020	0.0000	0.0000	0.0000	0.0000	72.3110	218.4941	389.0485	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1639.3347	
Space heating per m2											(98c) / (4) =	17.6273	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	263.3346	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	409.0823	275.7865	186.5030	71.2072	16.9020	0.0000	0.0000	0.0000	0.0000	72.3110	218.4941	389.0485	(98)
Space heating efficiency (main heating system 1)	263.3346	263.3346	263.3346	263.3346	263.3346	0.0000	0.0000	0.0000	0.0000	263.3346	263.3346	263.3346	(210)
Space heating fuel (main heating system)	155.3469	104.7285	70.8236	27.0406	6.4185	0.0000	0.0000	0.0000	0.0000	27.4597	82.9720	147.7392	(211)

Space heating efficiency (main heating system 2)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
261.7606	213.0196	180.1859	117.2153	82.0470	62.2468	59.2665	79.6018	116.3611	175.4434	226.2028	265.0471	(64)
Efficiency of water heater											183.5067	(216)
(217)m 183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	183.5067	(217)
Fuel for water heating, kWh/month												
142.6436	116.0827	98.1903	63.8752	44.7106	33.9207	32.2966	43.3781	63.4097	95.6060	123.2668	144.4346	(219)
Space cooling fuel requirement												
(221)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa 9.6887	8.7511	9.6887	9.3762	9.6887	9.3762	9.6887	9.6887	9.3762	9.6887	9.3762	9.6887	(231)
Lighting 30.8364	24.7381	22.2739	16.3188	12.6051	10.2985	11.4988	14.9466	19.4142	25.4724	28.7711	31.6934	(232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m -47.0723	-59.6497	-86.2232	-97.6472	-101.6061	-97.0465	-95.8370	-91.2375	-82.3823	-70.2340	-50.1558	-40.2995	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m -19.5974	-34.3720	-72.0370	-120.0779	-158.2024	-176.2978	-174.9382	-145.9290	-104.3547	-58.0325	-26.0504	-15.3106	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	622.5291	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5067	
Water heating fuel used	1001.8150	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	34.0771	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	114.0771	(231)
Electricity for lighting (calculated in Appendix L)	248.8674	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2024.5910	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-37.3024	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	498.0232	27.8600	155.3833	(240)
Space heating - main system 1 (low-rate cost)	124.5058	0.1450	18.0533	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	701.2705	31.2000	218.7964	(245)
Low-rate cost	300.5445	14.5000	43.5790	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	34.0771	29.5300	8.9817	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	248.8674	29.5300	73.4906	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-919.3912	29.5300	-271.4962	
PV Unit electricity exported	-1105.1997	5.8100	-64.2121	
Total			-335.7083	(252)
Total energy cost			209.1999	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	498.0232	0.1651	82.2423	(261)
Space heating - main system 1 (low-rate cost)	124.5058	0.1386	17.2598	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	701.2705	0.1543	108.1877	(264)
Water heating - low rate cost	300.5445	0.1295	38.9184	(264)
Space and water heating			246.6082	(265)
Pumps, fans and electric keep-hot	114.0771	0.1432	16.1847	(267)
Energy for lighting	248.8674	0.1490	37.0862	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-919.3912	0.1393	-128.0420	
PV Unit electricity exported	-1105.1997	0.1240	-137.0177	
Total			-265.0597	(269)
Total CO2, kg/year			34.8193	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	498.0232	1.2923	804.4700	(275)
Space heating - main system 1 (low-rate cost)	124.5058	1.5023	187.0469	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	701.2705	1.5760	1105.1707	(278)
Water heating - low rate cost	300.5445	1.4657	440.5158	(278)
Space and water heating			2537.2033	(279)
Pumps, fans and electric keep-hot	114.0771	1.5335	174.2360	(281)
Energy for lighting	248.8674	1.5547	386.9253	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-919.3912	1.5191	-1396.6680	
PV Unit electricity exported	-1105.1997	0.4549	-502.7364	
Total			-1899.4044	(283)
Total Primary energy kWh/year			1198.9602	(286)

Full SAP Calculation Printout

Property Reference	HT6 Havant	**Issued on Date**	22/06/2025
Assessment Reference	4B6P ASHP	**Prop Type Ref**	4B6P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	82 B	**DER**	3.85	**TER**	9.79
Environmental	96 A	**% DER < TER**			60.67
CO_2 Emissions (t/year)	0.37	**DFEE**	31.77	**TFEE**	36.12
Compliance Check	See BREL	**% DFEE < TFEE**			12.05
% DPER < TPER	20.84	**DPER**	40.29	**TPER**	50.90

Assessor Details	Mrs. Rebecca Lennon	**Assessor ID**	P627-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000 (1b)	x	2.4000 (2b)	=	127.4400	(1b) - (3b)
First floor	53.1000 (1c)	x	2.6000 (2c)	=	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.5000	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			0 * 10 =	0.0000	(7a)
Number of passive vents			0 * 10 =	0.0000	(7b)
Number of flueless gas fires			0 * 40 =	0.0000	(7c)
				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				4.0000	(17)
Infiltration rate				0.2000	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15654.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4040	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.4744 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 60.4461 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	(38)
Heat transfer coeff	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	(39)

Average = Sum(39)m / 12 = 104.2536

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	(40)
HLP (average)												0.9817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7900 (42)

Hot water usage for mixer showers

70.9987	69.9317	68.3770	65.4022	63.2068	60.7586	59.3670	60.9101	62.6015	65.2301	68.2688	70.7267	(42a)

Hot water usage for baths

30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)

Hot water usage for other uses

43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)

Average daily hot water use (litres/day) 133.1552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)

Energy content (annual) Total = Sum(45)m = 2211.6808

Distribution loss (46)m = 0.15 x (45)m

34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(64)

Total per year (kWh/year) = Sum(64)m = 2747.7198 (64)

12Total per year (kWh/year) 2748 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

112.7023	100.0178	106.9427	95.4516	93.5436	85.3776	84.9560	87.6557	87.8913	96.7242	101.3126	111.6398	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	134.5306	148.9445	134.5306	139.0149	134.5306	139.0149	134.5306	134.5306	139.0149	134.5306	139.0149	134.5306	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	265.9791	268.7391	261.7839	246.9771	228.2863	210.7195	198.9838	196.2237	203.1789	217.9857	236.6766	254.2434	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)
Water heating gains (Table 5)	151.4815	148.8361	143.7402	132.5716	125.7306	118.5800	114.1881	117.8168	122.0712	130.0056	140.7119	150.0536	(72)
Total internal gains	616.8410	631.3695	604.9045	583.4135	553.3972	533.1641	512.5523	513.4209	529.1148	547.3716	581.2532	603.6773	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	19.6403	0.3900	0.0000	0.7700	56.9744	(76)

South				5.9900		46.7521		0.3900	0.0000		0.7700		84.0975 (78)
West				9.8200		19.6403		0.3900	0.0000		0.7700		57.9181 (80)
Solar gains	198.9900	362.4841	545.5815	738.1134	868.2044	876.0924	839.0510	742.5229	613.7573	415.2443	242.9416	167.1499 (83)	
Total gains	815.8309	993.8536	1150.4860	1321.5269	1421.6017	1409.2566	1351.6033	1255.9438	1142.8721	962.6160	824.1948	770.8272 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	
alpha	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	
util living area	0.9689	0.9388	0.8832	0.7720	0.6212	0.4583	0.3356	0.3756	0.5839	0.8351	0.9452	0.9743	(86)
Living	19.5122	19.8332	20.2244	20.6225	20.8647	20.9665	20.9920	20.9877	20.9186	20.5612	19.9513	19.4342	
Non living	18.3690	18.7694	19.2489	19.7160	19.9787	20.0755	20.0948	20.0924	20.0370	19.6601	18.9232	18.2709	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2389	19.8332	20.2244	20.6225	20.8647	20.9665	20.9920	20.9877	20.9186	20.5612	19.9513	19.6532	(87)
Th 2	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	(88)
util rest of house	0.9633	0.9284	0.8645	0.7393	0.5739	0.3986	0.2685	0.3046	0.5203	0.8019	0.9341	0.9696	(89)
MIT 2	19.4091	18.7694	19.2489	19.7160	19.9787	20.0755	20.0948	20.0924	20.0370	19.6601	18.9232	18.6002	(90)
Living area fraction									fLA = Living area / (4) =			0.1309	(91)
MIT	19.5177	18.9087	19.3766	19.8346	20.0947	20.1922	20.2123	20.2096	20.1524	19.7780	19.0577	18.7380	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5177	18.9087	19.3766	19.8346	20.0947	20.1922	20.2123	20.2096	20.1524	19.7780	19.0577	18.7380	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9590	0.9114	0.8471	0.7288	0.5737	0.4049	0.2770	0.3134	0.5243	0.7884	0.9177	0.9603	(94)
Useful gains	782.3748	905.7727	974.5510	963.1734	815.5695	570.6707	374.4201	393.6555	599.2127	758.9628	756.3864	740.2259	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1586.5016	1460.4530	1342.4267	1139.9735	875.1758	583.0025	376.5919	397.1656	630.9820	956.8400	1246.6373	1515.6433	(97)
Space heating kWh	598.2703	372.7452	273.6995	127.2961	44.3471	0.0000	0.0000	0.0000	0.0000	147.2206	352.9807	576.9105	(98a)
Space heating requirement - total per year (kWh/year)												2493.4701	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	598.2703	372.7452	273.6995	127.2961	44.3471	0.0000	0.0000	0.0000	0.0000	147.2206	352.9807	576.9105	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2493.4701	
Space heating per m2										(98c) / (4) =		23.4790	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												261.1691	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement	598.2703	372.7452	273.6995	127.2961	44.3471	0.0000	0.0000	0.0000	0.0000	147.2206	352.9807	576.9105	(98)
Space heating efficiency (main heating system 1)	261.1691	261.1691	261.1691	261.1691	261.1691	0.0000	0.0000	0.0000	0.0000	261.1691	261.1691	261.1691	(210)
Space heating fuel (main heating system)	229.0739	142.7218	104.7978	48.7409	16.9802	0.0000	0.0000	0.0000	0.0000	56.3698	135.1541	220.8954	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(64)
Efficiency of water heater												183.3554	(216)
(217)m	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	(217)
Fuel for water heating, kWh/month	149.9509	132.5236	140.5037	122.7814	118.5255	106.2573	104.4396	108.8679	110.3804	123.7426	132.3950	148.2083	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.3050	2.9852	3.3050	3.1984	3.3050	3.1984	3.3050	3.3050	3.1984	3.3050	3.1984	3.3050	(231)
Lighting	33.7904	27.1079	24.4077	17.8821	13.8126	11.2850	12.6004	16.3784	21.2739	27.9126	31.5272	34.7295	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												954.7338	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3554	
Water heating fuel used	1498.5762	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	38.9139	(230a)
Total electricity for the above, kWh/year	38.9139	(231)
Electricity for lighting (calculated in Appendix L)	272.7077	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2764.9316	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	763.7871	0.1643	125.4913	(261)
Space heating - main system 1 (low-rate cost)	190.9468	0.1379	26.3378	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1049.0033	0.1480	155.2140	(264)
Water heating - low rate cost	449.5728	0.1242	55.8290	(264)
Space and water heating			362.8720	(265)
Pumps, fans and electric keep-hot	38.9139	0.1432	5.3996	(267)
Energy for lighting	272.7077	0.1490	40.6388	(268)
Total CO2, kg/year			408.9105	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.8500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	763.7871	1.2899	1231.4805	(275)
Space heating - main system 1 (low-rate cost)	190.9468	1.4995	286.3325	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1049.0033	1.5531	1629.1898	(278)
Water heating - low rate cost	449.5728	1.4444	649.3716	(278)
Space and water heating			3796.3745	(279)
Pumps, fans and electric keep-hot	38.9139	1.5335	58.8750	(281)
Energy for lighting	272.7077	1.5547	423.9908	(282)
Total Primary energy kWh/year			4279.2402	(286)
Dwelling Primary energy Rate (DPER)			40.2900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000	(1b)	x 2.4000	(2b) =	127.4400	(1b) - (3b)
First floor	53.1000	(1c)	x 2.6000	(2c) =	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 106.2000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		265.5000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1507	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4007	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3406	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4342	0.4257	0.4172	0.3746	0.3661	0.3235	0.3235	0.3150	0.3406	0.3661	0.3831	0.4002	(22b)
Effective ac	0.5943	0.5906	0.5870	0.5702	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5801	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			24.5800	1.1450	28.1450			(27)
Heatloss Floor 1			53.1000	0.1300	6.9030			(28a)
External Wall 1	104.0000	26.5400	77.4600	0.1800	13.9428			(29a)
External Roof 1	53.1000		53.1000	0.1100	5.8410			(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.7918			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.4040	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.8000	0.0600	0.7080
E12 Gable (insulation at ceiling level)	9.0000	0.0600	0.5400
P1 Party wall - Ground floor	9.0000	0.0800	0.7200
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.1200	1.0800
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0500	0.6625
E4 Jamb	46.2000	0.0500	2.3100
E5 Ground floor (normal)	20.8000	0.1600	3.3280
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.5575	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	68.3493	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0671	51.7463	51.4320	49.9553	49.6791	48.3930	48.3930	48.1548	48.8884	49.6791	50.2380	50.8222	(38)
Heat transfer coeff	120.4164	120.0957	119.7813	118.3047	118.0284	116.7423	116.7423	116.5041	117.2377	118.0284	118.5873	119.1716	(39)
Average = Sum(39)m / 12 =												118.3033	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1339	1.1308	1.1279	1.1140	1.1114	1.0993	1.0993	1.0970	1.1039	1.1114	1.1166	1.1221	(40)
HLP (average)												1.1140	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7900	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
70.9987	69.9317	68.3770	65.4022	63.2068	60.7586	59.3670	60.9101	62.6015	65.2301	68.2688	70.7267	(42a)

Hot water usage for baths

30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)

Hot water usage for other uses

43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)

Average daily hot water use (litres/day)	133.1552	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)
Energy content (annual)										Total = Sum(45)m =		2211.6808	
Distribution loss (46)m = 0.15 x (45)m	34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)

Water storage loss:		
Store volume	210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.7016	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.9188	(55)

Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

281.1631	248.6071	263.8411	231.1456	223.5429	200.8478	197.7156	205.8351	208.4078	233.1086	248.7727	277.9679	(62)
WWHRS -32.4577	-28.7058	-30.0591	-24.8901	-23.1967	-19.8496	-18.6058	-19.7854	-20.5371	-24.2110	-27.4281	-31.8566	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

248.7054	219.9013	233.7820	206.2555	200.3462	180.9982	179.1098	186.0497	187.8707	208.8976	221.3446	246.1113	(64)

Total per year (kWh/year) = Sum(64)m =	2519.3723	(64)
12Total per year (kWh/year)	2519	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)

Heat gains from water heating, kWh/month

117.6782	104.5123	111.9187	100.2671	98.5195	90.1930	89.9320	92.6317	92.7067	101.7001	106.1281	116.6158	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	134.1559	148.5297	134.1559	138.6278	134.1559	138.6278	134.1559	134.1559	138.6278	134.1559	138.6278	134.1559	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	265.9791	268.7391	261.7839	246.9771	228.2863	210.7195	198.9838	196.2237	203.1789	217.9857	236.6766	254.2434	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)
Water heating gains (Table 5)													
	158.1697	155.5242	150.4283	139.2598	132.4187	125.2681	120.8763	124.5050	128.7594	136.6937	147.4001	156.7417	(72)
Total internal gains													
	626.1545	640.6429	614.2180	592.7145	562.7107	539.4651	518.8658	519.7344	535.4159	556.6851	590.5543	612.9908	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.3200	19.6403	0.6300	0.7000	0.7700	55.9416	(76)
South	5.7800	46.7521	0.6300	0.7000	0.7700	82.5849	(78)
West	9.4800	19.6403	0.6300	0.7000	0.7700	56.9020	(80)

Solar gains	195.4285	355.9988	535.8253	724.9203	852.6901	860.4387	824.0585	729.2526	602.7841	407.8165	238.5939	164.1580	(83)
Total gains	821.5830	996.6417	1150.0433	1317.6348	1415.4009	1399.9038	1342.9243	1248.9870	1138.1999	964.5017	829.1482	777.1488	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1115	36.2079	36.3030	36.7561	36.8421	37.2480	37.2480	37.3241	37.0906	36.8421	36.6685	36.4887	
alpha	3.4074	3.4139	3.4202	3.4504	3.4561	3.4832	3.4832	3.4883	3.4727	3.4561	3.4446	3.4326	
util living area													
	0.9714	0.9467	0.9016	0.8063	0.6688	0.5040	0.3741	0.4160	0.6305	0.8586	0.9511	0.9759	(86)
MIT	19.1800	19.5131	19.9479	20.4431	20.7721	20.9370	20.9829	20.9752	20.8619	20.3970	19.7037	19.1277	(87)
Th 2	19.9733	19.9757	19.9781	19.9894	19.9916	20.0014	20.0014	20.0033	19.9976	19.9916	19.9873	19.9828	(88)
util rest of house													
	0.9659	0.9369	0.8839	0.7736	0.6176	0.4346	0.2927	0.3311	0.5601	0.8262	0.9404	0.9712	(89)
MIT 2	17.8672	18.2860	18.8250	19.4230	19.7890	19.9583	19.9936	19.9911	19.8931	19.3879	18.5391	17.8075	(90)
Living area fraction									fLA = Living area / (4) =			0.1309	(91)
MIT	18.0390	18.4466	18.9719	19.5565	19.9177	20.0864	20.1231	20.1199	20.0199	19.5199	18.6916	17.9803	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0390	18.4466	18.9719	19.5565	19.9177	20.0864	20.1231	20.1199	20.0199	19.5199	18.6916	17.9803	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9514	0.9178	0.8627	0.7579	0.6135	0.4407	0.3028	0.3413	0.5618	0.8083	0.9222	0.9581	(94)
Useful gains	781.6746	914.7564	992.1739	998.6138	868.4017	616.9861	406.6419	426.2699	639.4598	779.5820	764.6566	744.5771	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1654.4025	1626.8925	1493.9045	1260.7132	969.9179	640.4994	411.2922	433.3829	694.0302	1052.8068	1374.6115	1642.2150	(97)
Space heating kWh													
	649.3096	478.5554	373.2876	188.7115	75.5281	0.0000	0.0000	0.0000	0.0000	203.2792	439.1675	667.8426	(98a)
Space heating requirement - total per year (kWh/year)												3075.6816	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	649.3096	478.5554	373.2876	188.7115	75.5281	0.0000	0.0000	0.0000	0.0000	203.2792	439.1675	667.8426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3075.6816	
Space heating per m2											(98c) / (4) =	28.9612	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	649.3096	478.5554	373.2876	188.7115	75.5281	0.0000	0.0000	0.0000	0.0000	203.2792	439.1675	667.8426	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	703.4773	518.4783	404.4286	204.4545	81.8290	0.0000	0.0000	0.0000	0.0000	220.2375	475.8045	723.5565	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	248.7054	219.9013	233.7820	206.2555	200.3462	180.9982	179.1098	186.0497	187.8707	208.8976	221.3446	246.1113	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1103	85.7550	85.1038	83.8609	82.0775	79.8000	79.8000	79.8000	79.8000	83.9987	85.5661	86.1826	(217)
Fuel for water heating, kWh/month													
	288.8217	256.4297	274.7023	245.9494	244.0941	226.8148	224.4484	233.1450	235.4269	248.6916	258.6826	285.5695	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	27.8749	22.3623	20.1348	14.7516	11.3946	9.3095	10.3945	13.5112	17.5497	23.0261	26.0080	28.6497	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.2563	-67.3189	-95.7543	-106.4820	-113.8012	-105.8058	-104.4279	-99.0319	-89.4303	-76.3440	-52.7693	-41.7988	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-29.4925	-61.7696	-122.2951	-183.0207	-241.4030	-242.3885	-239.6011	-203.2017	-149.3384	-88.1957	-39.3250	-23.3486	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3332.2661	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3022.7760	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	224.9668	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2624.6005	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4041.4084	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3332.2661	0.2100	699.7759	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3022.7760	0.2100	634.7830	(264)
Space and water heating			1334.5588	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	224.9668	0.1443	32.4697	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1001.2207	0.1348	-134.9903	
PV Unit electricity exported	-1623.3798	0.1260	-204.5396	
Total			-339.5299	(269)
Total CO2, kg/year			1039.4278	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.7900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3332.2661	1.1300	3765.4607	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3022.7760	1.1300	3415.7369	(278)
Space and water heating			7181.1976	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	224.9668	1.5338	345.0616	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1001.2207	1.4983	-1500.1355	
PV Unit electricity exported	-1623.3798	0.4625	-750.8077	
Total			-2250.9432	(283)
Total Primary energy kWh/year			5405.4168	(286)
Target Primary Energy Rate (TPER)			50.9000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000	(1b) x	2.4000	(2b) =	127.4400	(1b) - (3b)
First floor	53.1000	(1c) x	2.6000	(2c) =	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		265.5000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1507	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3507	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2981	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3800	0.3726	0.3651	0.3279	0.3204	0.2832	0.2832	0.2757	0.2981	0.3204	0.3353	0.3502	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5722	0.5694	0.5667	0.5537	0.5513	0.5401	0.5401	0.5380	0.5444	0.5513	0.5562	0.5613	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15654.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.4040	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.4744	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 60.4461	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.1342	49.8885	49.6477	48.5166	48.3050	47.3199	47.3199	47.1375	47.6994	48.3050	48.7331	49.1807	(38)
Heat transfer coeff	110.5803	110.3346	110.0938	108.9627	108.7511	107.7660	107.7660	107.5836	108.1454	108.7511	109.1792	109.6268	(39)

Average = Sum(39)m / 12 =	108.9617

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0412	1.0389	1.0367	1.0260	1.0240	1.0147	1.0147	1.0130	1.0183	1.0240	1.0281	1.0323	(40)
HLP (average)												1.0260	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7900	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)

Hot water usage for other uses

43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)

Average daily hot water use (litres/day)	67.6968 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.8573	71.8310	69.6189	66.8658	64.4097	61.8572	61.3270	63.5347	65.7988	68.4200	71.1975	73.7536	(44)
Energy conte	116.9718	102.2864	107.0016	91.5359	86.7078	76.0606	74.1697	78.6692	81.1365	92.8453	101.4339	115.4804	(45)

Energy content (annual)	Total = Sum(45)m = 1124.2992

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	99.4261	86.9434	90.9514	77.8055	73.7016	64.6515	63.0443	66.8688	68.9661	78.9185	86.2188	98.1583 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	99.4261	86.9434	90.9514	77.8055	73.7016	64.6515	63.0443	66.8688	68.9661	78.9185	86.2188	98.1583 (64)

Total per year (kWh/year) = Sum(64)m = 955.6543 (64)

12Total per year (kWh/year) 956 (64)

Electric shower(s)

	56.8581	50.6611	55.3200	52.7912	53.7818	51.3026	53.0127	53.7818	52.7912	55.3200	54.2797	56.8581 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 646.7580 (64a)

Heat gains from water heating, kWh/month

	39.0711	34.4011	36.5678	32.6492	31.8708	28.9885	29.0142	30.1626	30.4393	33.5596	35.1246	38.7541 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	134.5306	148.9445	134.5306	139.0149	134.5306	139.0149	134.5306	134.5306	139.0149	134.5306	139.0149	134.5306	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	265.9791	268.7391	261.7839	246.9771	228.2863	210.7195	198.9838	196.2237	203.1789	217.9857	236.6766	254.2434	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)

Water heating gains (Table 5)

	52.5149	51.1921	49.1503	45.3461	42.8372	40.2618	38.9976	40.5412	42.2768	45.1070	48.7842	52.0889	(72)

Total internal gains

	517.8743	533.7256	510.3146	496.1879	470.5038	454.8460	437.3617	436.1453	449.3204	462.4731	489.3255	505.7126	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	19.6403	0.3900	0.0000	0.7700	56.9744	(76)
South	5.9900	46.7521	0.3900	0.0000	0.7700	84.0975	(78)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	198.9900	362.4841	545.5815	738.1134	868.2044	876.0924	839.0510	742.5229	613.7573	415.2443	242.9416	167.1499	(83)
Total gains	716.8642	896.2097	1055.8961	1234.3014	1338.7082	1330.9385	1276.4128	1178.6682	1063.0777	877.7174	732.2671	672.8625	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.3236	39.4112	39.4974	39.9074	39.9850	40.3505	40.3505	40.4190	40.2090	39.9850	39.8282	39.6656	
alpha	3.6216	3.6274	3.6332	3.6605	3.6657	3.6900	3.6900	3.6946	3.6806	3.6657	3.6552	3.6444	
util living area	0.9799	0.9568	0.9116	0.8105	0.6649	0.4951	0.3654	0.4098	0.6317	0.8725	0.9627	0.9837	(86)
MIT	19.2387	19.5846	20.0231	20.5084	20.8125	20.9523	20.9879	20.9816	20.8843	20.4352	19.7445	19.1794	(87)
Th 2	20.0491	20.0510	20.0529	20.0617	20.0634	20.0711	20.0711	20.0725	20.0681	20.0634	20.0600	20.0565	(88)
util rest of house	0.9760	0.9488	0.8958	0.7796	0.6162	0.4305	0.2908	0.3313	0.5650	0.8434	0.9544	0.9805	(89)
MIT 2	18.4454	18.7859	19.2110	19.6691	19.9325	20.0453	20.0666	20.0653	19.9988	19.6165	18.9538	18.3922	(90)
Living area fraction									fLA = Living area / (4) =			0.1309	(91)
MIT	18.5492	18.8905	19.3173	19.7790	20.0476	20.1640	20.1872	20.1852	20.1147	19.7237	19.0573	18.4952	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5492	18.8905	19.3173	19.7790	20.0476	20.1640	20.1872	20.1852	20.1147	19.7237	19.0573	18.4952	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9677	0.9365	0.8812	0.7693	0.6153	0.4371	0.3003	0.3410	0.5686	0.8310	0.9431	0.9733	(94)
Useful gains	693.7045	839.3141	930.4950	949.5238	823.7237	581.8058	383.2834	401.9359	604.4479	729.3930	690.5934	654.8825	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1575.6797	1543.6325	1411.1051	1185.4055	907.8143	599.6065	386.5791	407.2258	650.4618	992.2077	1305.4861	1567.1387	(97)
Space heating kWh	656.1896	473.3020	357.5739	169.8348	62.5634	0.0000	0.0000	0.0000	0.0000	195.5342	442.7227	678.7186	(98a)

Space heating requirement - total per year (kWh/year) 3036.4392

Solar heating kWh

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

	656.1896	473.3020	357.5739	169.8348	62.5634	0.0000	0.0000	0.0000	0.0000	195.5342	442.7227	678.7186	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 3036.4392

Space heating per m2 (98c) / (4) = 28.5917 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1013.0003	797.4683	817.6350	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9095	0.9462	0.9287	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	921.3033	754.5671	759.3048	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1500.8732	1439.7459	1328.1584	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	417.2903	509.7730	423.2271	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	104.3226	127.4433	105.8068	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												337.5726	(107)
Energy for space heating												28.5917	(99)
Energy for space cooling												3.1786	(108)
Total												31.7704	(109)
Fabric Energy Efficiency (DFEE)												31.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000	(1b)	x 2.4000	(2b) =	127.4400	(1b) - (3b)
First floor	53.1000	(1c)	x 2.6000	(2c) =	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		265.5000	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1507	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4007	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3406	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4342	0.4257	0.4172	0.3746	0.3661	0.3235	0.3235	0.3150	0.3406	0.3661	0.3831	0.4002	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5943	0.5906	0.5870	0.5702	0.5670	0.5523	0.5523	0.5496	0.5580	0.5670	0.5734	0.5801	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			24.5800	1.1450	28.1450			(27)
Heatloss Floor 1			53.1000	0.1300	6.9030			(28a)
External Wall 1	104.0000	26.5400	77.4600	0.1800	13.9428			(29a)
External Roof 1	53.1000		53.1000	0.1100	5.8410			(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.7918			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.4040	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.8000	0.0600	0.7080
E12 Gable (insulation at ceiling level)	9.0000	0.0600	0.5400
P1 Party wall - Ground floor	9.0000	0.0800	0.7200
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.1200	1.0800
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0500	0.6625
E4 Jamb	46.2000	0.0500	2.3100

E5 Ground floor (normal)												20.8000	0.1600	3.3280	
E6 Intermediate floor within a dwelling												20.8000	0.0000	0.0000	
E16 Corner (normal)												10.0000	0.0900	0.9000	
E18 Party wall between dwellings												10.0000	0.0600	0.6000	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)														11.5575	(36)
Point Thermal bridges													(36a) =	0.0000	
Total fabric heat loss												(33) + (36) + (36a) =		68.3493	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0671	51.7463	51.4320	49.9553	49.6791	48.3930	48.3930	48.1548	48.8884	49.6791	50.2380	50.8222	(38)
Heat transfer coeff													
	120.4164	120.0957	119.7813	118.3047	118.0284	116.7423	116.7423	116.5041	117.2377	118.0284	118.5873	119.1716	(39)
Average = Sum(39)m / 12 =												118.3033	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1339	1.1308	1.1279	1.1140	1.1114	1.0993	1.0993	1.0970	1.1039	1.1114	1.1166	1.1221	(40)
HLP (average)												1.1140	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7900	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)
Hot water usage for other uses													
	43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)
Average daily hot water use (litres/day)												67.6968	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	73.8573	71.8310	69.6189	66.8658	64.4097	61.8572	61.3270	63.5347	65.7988	68.4200	71.1975	73.7536	(44)
Energy conte	116.9718	102.2864	107.0016	91.5359	86.7078	76.0606	74.1697	78.6692	81.1365	92.8453	101.4339	115.4804	(45)
Energy content (annual)										Total = Sum(45)m =		1124.2992	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	99.4261	86.9434	90.9514	77.8055	73.7016	64.6515	63.0443	66.8688	68.9661	78.9185	86.2188	98.1583	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	99.4261	86.9434	90.9514	77.8055	73.7016	64.6515	63.0443	66.8688	68.9661	78.9185	86.2188	98.1583	(64)
										Total per year (kWh/year) = Sum(64)m =		955.6543	(64)
12Total per year (kWh/year)												956	(64)
Electric shower(s)													
	56.8581	50.6611	55.3200	52.7912	53.7818	51.3026	53.0127	53.7818	52.7912	55.3200	54.2797	56.8581	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		646.7580	(64a)
Heat gains from water heating, kWh/month													
	39.0711	34.4011	36.5678	32.6492	31.8708	28.9885	29.0142	30.1626	30.4393	33.5596	35.1246	38.7541	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	139.4994	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	134.1559	148.5297	134.1559	138.6278	134.1559	138.6278	134.1559	134.1559	138.6278	134.1559	138.6278	134.1559	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	265.9791	268.7391	261.7839	246.9771	228.2863	210.7195	198.9838	196.2237	203.1789	217.9857	236.6766	254.2434	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	36.9499	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)
Water heating gains (Table 5)													
	52.5149	51.1921	49.1503	45.3461	42.8372	40.2618	38.9976	40.5412	42.2768	45.1070	48.7842	52.0889	(72)
Total internal gains													
	517.4996	533.3108	509.9400	495.8008	470.1291	454.4589	436.9871	435.7706	448.9333	462.0984	488.9384	505.3379	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.3200	19.6403	0.6300	0.7000	0.7700	55.9416	(76)
South	5.7800	46.7521	0.6300	0.7000	0.7700	82.5849	(78)
West	9.4800	19.6403	0.6300	0.7000	0.7700	56.9020	(80)

Solar gains	195.4285	355.9988	535.8253	724.9203	852.6901	860.4387	824.0585	729.2526	602.7841	407.8165	238.5939	164.1580	(83)
Total gains	712.9281	889.3096	1045.7652	1220.7211	1322.8193	1314.8975	1261.0456	1165.0232	1051.7174	869.9150	727.5323	669.4960	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.1115	36.2079	36.3030	36.7561	36.8421	37.2480	37.2480	37.3241	37.0906	36.8421	36.6685	36.4887	
alpha	3.4074	3.4139	3.4202	3.4504	3.4561	3.4832	3.4832	3.4883	3.4727	3.4561	3.4446	3.4326	
util living area													
	0.9810	0.9606	0.9215	0.8326	0.6985	0.5310	0.3966	0.4429	0.6659	0.8870	0.9657	0.9844	(86)
MIT	19.0317	19.3791	19.8379	20.3737	20.7378	20.9259	20.9794	20.9699	20.8356	20.3117	19.5741	18.9782	(87)
Th 2	19.9733	19.9757	19.9781	19.9894	19.9916	20.0014	20.0014	20.0033	19.9976	19.9916	19.9873	19.9828	(88)
util rest of house													
	0.9771	0.9530	0.9065	0.8024	0.6479	0.4595	0.3110	0.3537	0.5954	0.8590	0.9578	0.9812	(89)
MIT 2	18.1865	18.5294	18.9764	19.4878	19.8079	19.9615	19.9940	19.9916	19.8990	19.4461	18.7337	18.1403	(90)
Living area fraction										fLA = Living area / (4) =		0.1309	(91)
MIT	18.2971	18.6406	19.0892	19.6038	19.9296	20.0877	20.1230	20.1196	20.0216	19.5594	18.8437	18.2499	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2971	18.6406	19.0892	19.6038	19.9296	20.0877	20.1230	20.1196	20.0216	19.5594	18.8437	18.2499	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9685	0.9402	0.8907	0.7893	0.6445	0.4660	0.3217	0.3645	0.5973	0.8445	0.9460	0.9737	(94)
Useful gains	690.4968	836.1468	931.4194	963.5102	852.5932	612.6935	405.6511	424.6052	628.1534	734.6849	688.2216	651.9154	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1685.4798	1650.1923	1507.9488	1266.3077	971.3315	640.6506	411.2835	433.3507	694.2338	1057.4668	1392.6560	1674.3516	(97)
Space heating kWh													
	740.2674	547.0386	428.9379	218.0142	88.3413	0.0000	0.0000	0.0000	0.0000	240.1497	507.1927	760.6925	(98a)
Space heating requirement - total per year (kWh/year)												3530.6343	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	740.2674	547.0386	428.9379	218.0142	88.3413	0.0000	0.0000	0.0000	0.0000	240.1497	507.1927	760.6925	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3530.6343	
Space heating per m2											(98c) / (4) =	33.2451	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1097.3777	863.8931	885.4315	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8770	0.9226	0.9006	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	962.3475	796.9946	797.4140	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1482.5438	1422.1867	1312.6017	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	374.5414	465.1429	383.2997	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	93.6353	116.2857	95.8249	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												305.7460	(107)
Energy for space heating												33.2451	(99)
Energy for space cooling												2.8790	(108)
Total												36.1241	(109)
Fabric Energy Efficiency (TFEE)												36.1	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		53.1000 (1b)	x	2.4000 (2b)	=	127.4400	(1b) - (3b)
First floor		53.1000 (1c)	x	2.6000 (2c)	=	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.5000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)

Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15654.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.4040	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4744	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.4461	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	(38)
Heat transfer coeff													
	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	(39)
Average = Sum(39)m / 12 =												104.2536	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	(40)
HLP (average)												0.9817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7900	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	70.9987	69.9317	68.3770	65.4022	63.2068	60.7586	59.3670	60.9101	62.6015	65.2301	68.2688	70.7267	(42a)
Hot water usage for baths													
	30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)
Hot water usage for other uses													
	43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)
Average daily hot water use (litres/day)												133.1552	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)
Energy content (annual)										Total = Sum(45)m =		2211.6808	
Distribution loss (46)m = 0.15 x (45)m													
	34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(64)

											Total per year (kWh/year) = Sum(64)m =	2747.7198	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000		(64a)
Heat gains from water heating, kWh/month													
112.7023	100.0178	106.9427	95.4516	93.5436	85.3776	84.9560	87.6557	87.8913	96.7242	101.3126	111.6398		(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
38.6046	34.2883	27.8851	21.1108	15.7806	13.3226	14.3956	18.7119	25.1151	31.8894	37.2196	39.6775		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
396.9837	401.1031	390.7223	368.6226	340.7258	314.5067	296.9907	292.8712	303.2521	325.3518	353.2486	379.4677		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299		(69)
Pumps, fans 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995		(71)
Water heating gains (Table 5)													
151.4815	148.8361	143.7402	132.5716	125.7306	118.5800	114.1881	117.8168	122.0712	130.0056	140.7119	150.0536		(72)
Total internal gains													
697.3995	694.5571	672.6772	632.6347	592.5666	556.7389	535.9041	539.7296	560.7681	597.5764	641.5098	679.5285		(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	19.6403	0.3900	0.0000	0.7700	56.9744	(76)
South	5.9900	46.7521	0.3900	0.0000	0.7700	84.0975	(78)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	198.9900	362.4841	545.5815	738.1134	868.2044	876.0924	839.0510	742.5229	613.7573	415.2443	242.9416	167.1499	(83)
Total gains	896.3894	1057.0412	1218.2587	1370.7481	1460.7710	1432.8313	1374.9551	1282.2525	1174.5253	1012.8207	884.4514	846.6784	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	
alpha	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	
util living area													
	0.9588	0.9276	0.8666	0.7568	0.6086	0.4515	0.3301	0.3683	0.5713	0.8169	0.9335	0.9659	(86)
Living	19.6203	19.9076	20.2864	20.6492	20.8739	20.9681	20.9924	20.9885	20.9244	20.5979	20.0241	19.5386	
Non living	18.5040	18.8605	19.3217	19.7449	19.9873	20.0767	20.0951	20.0929	20.0416	19.7001	19.0120	18.4018	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2942	19.9076	20.2864	20.6492	20.8739	20.9681	20.9924	20.9885	20.9244	20.5979	20.0241	19.7431	(87)
Th 2	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	(88)
util rest of house													
	0.9517	0.9158	0.8462	0.7232	0.5614	0.3925	0.2640	0.2985	0.5083	0.7818	0.9204	0.9598	(89)
MIT 2	19.4629	18.8605	19.3217	19.7449	19.9873	20.0767	20.0951	20.0929	20.0416	19.7001	19.0120	18.7076	(90)
Living area fraction										fLA = Living area / (4) =		0.1309	(91)
MIT	19.5717	18.9975	19.4480	19.8632	20.1033	20.1934	20.2125	20.2101	20.1572	19.8177	19.1445	18.8431	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5717	18.9975	19.4480	19.8632	20.1033	20.1934	20.2125	20.2101	20.1572	19.8177	19.1445	18.8431	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9468	0.8982	0.8293	0.7138	0.5617	0.3988	0.2724	0.3072	0.5126	0.7696	0.9033	0.9490	(94)
Useful gains	848.6849	949.4079	1010.3487	978.3816	820.5021	571.4180	374.5683	393.9374	602.0115	779.4251	798.9387	803.4947	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1592.1304	1469.7200	1349.8753	1142.9567	876.0743	583.1320	376.6175	397.2143	631.4822	960.9731	1255.6773	1526.5984		(97)
Space heating kWh													
553.1234	349.6497	252.6078	118.4940	41.3457	0.0000	0.0000	0.0000	0.0000	135.0717	328.8518	537.9892		(98a)
Space heating requirement - total per year (kWh/year)												2317.1333	
Solar heating kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
553.1234	349.6497	252.6078	118.4940	41.3457	0.0000	0.0000	0.0000	0.0000	135.0717	328.8518	537.9892		(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2317.1333	
Space heating per m2											(98c) / (4) =	21.8186	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	261.1691	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	553.1234	349.6497	252.6078	118.4940	41.3457	0.0000	0.0000	0.0000	0.0000	135.0717	328.8518	537.9892	(98)

Space heating efficiency (main heating system 1)

	261.1691	261.1691	261.1691	261.1691	261.1691	0.0000	0.0000	0.0000	0.0000	261.1691	261.1691	261.1691 (210)

Space heating fuel (main heating system)

	211.7874	133.8786	96.7219	45.3706	15.8310	0.0000	0.0000	0.0000	0.0000	51.7181	125.9153	205.9926 (211)

Space heating efficiency (main heating system 2)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

Space heating fuel (main heating system 2)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Space heating fuel (secondary)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479 (64)

Efficiency of water heater 183.3554 (216)

(217)m	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554 (217)

Fuel for water heating, kWh/month

	149.9509	132.5236	140.5037	122.7814	118.5255	106.2573	104.4396	108.8679	110.3804	123.7426	132.3950	148.2083 (219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	3.3050	2.9852	3.3050	3.1984	3.3050	3.1984	3.3050	3.3050	3.1984	3.3050	3.1984	3.3050 (231)
Lighting	33.7904	27.1079	24.4077	17.8821	13.8126	11.2850	12.6004	16.3784	21.2739	27.9126	31.5272	34.7295 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1 887.2156 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 183.3554
Water heating fuel used 1498.5762 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)
mechanical ventilation fans (SFP = 0.1201) 38.9139 (230a)
Total electricity for the above, kWh/year 38.9139 (231)
Electricity for lighting (calculated in Appendix L) 272.7077 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2697.4134 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	709.7725	17.5600	139.1154	(240)
Space heating - main system 1 (low-rate cost)	177.4431	0.0940	16.6797	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1049.0033	19.6000	205.6046	(245)
Low-rate cost	449.5728	9.4000	42.2598	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	38.9139	18.5800	6.4760	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	272.7077	18.5800	50.6691	(250)
Additional standing charges			7.0000	(251)
Total energy cost			467.8047	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.1138 (257)
SAP value 81.9450
SAP rating (Section 12) 82 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	709.7725	0.1643	116.6278	(261)
Space heating - main system 1 (low-rate cost)	177.4431	0.1379	24.4778	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1049.0033	0.1480	155.2140	(264)
Water heating - low rate cost	449.5728	0.1242	55.8290	(264)
Space and water heating			352.1486	(265)
Pumps, fans and electric keep-hot	38.9139	0.1432	5.3996	(267)
Energy for lighting	272.7077	0.1490	40.6388	(268)
Total CO2, kg/year			398.1870	(272)
CO2 emissions per m2			3.7500	(273)

EI value 96.4711
EI rating 96 (274)
EI band A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000 (1b)	x	2.4000 (2b)	=	127.4400	(1b) - (3b)
First floor	53.1000 (1c)	x	2.6000 (2c)	=	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.5000	(5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15654.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		147.4040 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4744 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.4461 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	(38)
Heat transfer coeff													
	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	(39)
Average = Sum(39)m / 12 =												104.2536	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	(40)
HLP (average)												0.9817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7900	(42)
Hot water usage for mixer showers													
	70.9987	69.9317	68.3770	65.4022	63.2068	60.7586	59.3670	60.9101	62.6015	65.2301	68.2688	70.7267	(42a)
Hot water usage for baths													
	30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)
Hot water usage for other uses													
	43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)
Average daily hot water use (litres/day)												133.1552	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)
Energy content (annual)										Total = Sum(45)m =		2211.6808	
Distribution loss (46)m = 0.15 x (45)m													
	34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(64)
										Total per year (kWh/year) = Sum(64)m =		2747.7198	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.7023	100.0178	106.9427	95.4516	93.5436	85.3776	84.9560	87.6557	87.8913	96.7242	101.3126	111.6398	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.6046	34.2883	27.8851	21.1108	15.7806	13.3226	14.3956	18.7119	25.1151	31.8894	37.2196	39.6775	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	396.9837	401.1031	390.7223	368.6226	340.7258	314.5067	296.9907	292.8712	303.2521	325.3518	353.2486	379.4677	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)
Water heating gains (Table 5)													
	151.4815	148.8361	143.7402	132.5716	125.7306	118.5800	114.1881	117.8168	122.0712	130.0056	140.7119	150.0536	(72)
Total internal gains													
	697.3995	694.5571	672.6772	632.6347	592.5666	556.7389	535.9041	539.7296	560.7681	597.5764	641.5098	679.5285	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	26.6540	0.3900	0.0000	0.7700	77.3206	(76)
South	5.9900	59.9148	0.3900	0.0000	0.7700	107.7746	(78)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	263.6965	405.7439	603.3607	838.2354	953.0864	1029.6753	989.7391	877.4036	728.6679	495.9215	310.1888	220.8235	(83)
Total gains	961.0960	1100.3011	1276.0379	1470.8701	1545.6530	1586.4142	1525.6432	1417.1332	1289.4360	1093.4979	951.6986	900.3520	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	
alpha	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	
util living area													
	0.9402	0.9083	0.8303	0.6875	0.5142	0.3378	0.2249	0.2419	0.4472	0.7265	0.8943	0.9483	(86)
Living	19.8524	20.0676	20.4392	20.7714	20.9384	20.9903	20.9985	20.9981	20.9725	20.7748	20.2924	19.8072	

Non living	18.7946	19.0579	19.5031	19.8785	20.0493	20.0932	20.0982	20.0980	20.0813	19.8938	19.3400	18.7397	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4129	20.0676	20.4392	20.7714	20.9384	20.9903	20.9985	20.9981	20.9725	20.7748	20.2924	19.9740	(87)
Th 2	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	(88)
util rest of house	0.9297	0.8933	0.8051	0.6483	0.4629	0.2808	0.1638	0.1763	0.3813	0.6788	0.8737	0.9389	(89)
MIT 2	19.5788	19.0579	19.5031	19.8785	20.0493	20.0932	20.0982	20.0980	20.0813	19.8938	19.3400	18.9846	(90)
Living area fraction									fLA = Living area / (4) =			0.1309	(91)
MIT	19.6879	19.1901	19.6256	19.9953	20.1657	20.2106	20.2160	20.2158	20.1979	20.0091	19.4647	19.1141	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6879	19.1901	19.6256	19.9953	20.1657	20.2106	20.2160	20.2158	20.1979	20.0091	19.4647	19.1141	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9242	0.8754	0.7904	0.6436	0.4668	0.2879	0.1717	0.1848	0.3887	0.6737	0.8565	0.9262	(94)
Useful gains	888.2592	963.2193	1008.5394	946.6515	721.5566	456.7900	262.0250	261.9228	501.2223	736.7169	815.1238	833.9044	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1499.9953	1406.3899	1274.5673	1052.4752	747.0497	459.8222	262.3043	262.2860	510.6283	834.9774	1143.1068	1419.3207	(97)
Space heating kWh	455.1316	297.8106	197.9247	76.1931	18.9669	0.0000	0.0000	0.0000	0.0000	73.1058	236.1478	435.5497	(98a)
Space heating requirement - total per year (kWh/year)												1790.8303	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	455.1316	297.8106	197.9247	76.1931	18.9669	0.0000	0.0000	0.0000	0.0000	73.1058	236.1478	435.5497	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1790.8303	
Space heating per m2											(98c) / (4) =	16.8628	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	261.1691	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	455.1316	297.8106	197.9247	76.1931	18.9669	0.0000	0.0000	0.0000	0.0000	73.1058	236.1478	435.5497	(98)
Space heating efficiency (main heating system 1)	261.1691	261.1691	261.1691	261.1691	261.1691	0.0000	0.0000	0.0000	0.0000	261.1691	261.1691	261.1691	(210)
Space heating fuel (main heating system)	174.2670	114.0298	75.7841	29.1739	7.2623	0.0000	0.0000	0.0000	0.0000	27.9918	90.4195	166.7692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	274.9431	242.9891	257.6211	225.1262	217.3229	194.8284	191.4956	199.6152	202.3884	226.8886	242.7533	271.7479	(64)
Efficiency of water heater												183.3554	(216)
(217)m	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	(217)
Fuel for water heating, kWh/month	149.9509	132.5236	140.5037	122.7814	118.5255	106.2573	104.4396	108.8679	110.3804	123.7426	132.3950	148.2083	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.3050	2.9852	3.3050	3.1984	3.3050	3.1984	3.3050	3.3050	3.1984	3.3050	3.1984	3.3050	(231)
Lighting	33.7904	27.1079	24.4077	17.8821	13.8126	11.2850	12.6004	16.3784	21.2739	27.9126	31.5272	34.7295	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	685.6975	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3554	
Water heating fuel used	1498.5762	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	38.9139	(230a)
Total electricity for the above, kWh/year	38.9139	(231)
Electricity for lighting (calculated in Appendix L)	272.7077	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2495.8953	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	548.5580	27.8600	171.1501	(240)
Space heating - main system 1 (low-rate cost)	137.1395	0.1450	19.8852	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1049.0033	31.2000	327.2890	(245)
Low-rate cost	449.5728	14.5000	65.1881	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	38.9139	29.5300	10.2565	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	272.7077	29.5300	80.5306	(250)
Additional standing charges			3.0000	(251)
Total energy cost			677.2995	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	548.5580	0.1653	90.6743	(261)
Space heating - main system 1 (low-rate cost)	137.1395	0.1388	19.0294	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1049.0033	0.1480	155.2140	(264)
Water heating - low rate cost	449.5728	0.1242	55.8290	(264)
Space and water heating			320.7467	(265)
Pumps, fans and electric keep-hot	38.9139	0.1432	5.3996	(267)
Energy for lighting	272.7077	0.1490	40.6388	(268)
Total CO2, kg/year			366.7851	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	548.5580	1.2927	886.4106	(275)
Space heating - main system 1 (low-rate cost)	137.1395	1.5028	206.0985	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1049.0033	1.5531	1629.1898	(278)
Water heating - low rate cost	449.5728	1.4444	649.3716	(278)
Space and water heating			3371.0706	(279)
Pumps, fans and electric keep-hot	38.9139	1.5335	58.8750	(281)
Energy for lighting	272.7077	1.5547	423.9908	(282)
Total Primary energy kWh/year			3853.9364	(286)

SAP 10 EPC IMPROVEMENTS

4B6P ASHP

Current energy efficiency rating: B 82
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.8	-£ 97	-48 kg (13.0%)
U Solar photovoltaic panels	+ 8.0	-£ 342	-265 kg (83.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£97	0.45 kg/m²	B 84	A 97
Solar photovoltaic panels	£342	2.50 kg/m²	A 92	A 99
Total Savings	£439	2.95 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£677	£580	£97
Space heating	£204	£228	-£24
Water heating	£392	£271	£121
Lighting	£81	£81	£0
Generated (PV)	-£0	-£342	£342
Total cost of fuels	£677	£238	£439
Total cost of uses	£677	£238	£439
Delivered energy	24 kWh/m²	1 kWh/m²	23 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m²	3 kg/m²	1 kg/m²	3 kg/m²
Primary energy	36 kWh/m²	13 kWh/m²	23 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000 (1b)	x	2.4000 (2b)	=	127.4400	(1b) - (3b)
First floor	53.1000 (1c)	x	2.6000 (2c)	=	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			15654.3000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4040	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4744	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	60.4461	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	(38)
Heat transfer coeff	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	(39)
Average = Sum(39)m / 12 =												104.2536	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	(40)
HLP (average)												0.9817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7900	(42)
Hot water usage for mixer showers													
	70.9987	69.9317	68.3770	65.4022	63.2068	60.7586	59.3670	60.9101	62.6015	65.2301	68.2688	70.7267	(42a)
Hot water usage for baths													
	30.6550	30.1997	29.5586	28.3765	27.4914	26.5099	25.9797	26.6164	27.3095	28.3598	29.5662	30.5514	(42b)
Hot water usage for other uses													
	43.2023	41.6313	40.0603	38.4893	36.9183	35.3473	35.3473	36.9183	38.4893	40.0603	41.6313	43.2023	(42c)
Average daily hot water use (litres/day)												133.1552	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)
Energy content (annual)										Total = Sum(45)m =		2211.6808	
Distribution loss (46)m = 0.15 x (45)m													
	34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	274.9431	242.9891	256.2253	218.3726	204.5286	182.2217	178.4687	187.5187	196.9856	225.4929	242.7533	271.7479	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												622.4117	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												622.4117	
Solar input	-0.0000	-16.2056	-58.4362	-80.3321	-104.8599	-96.5368	-95.7441	-83.7842	-57.8305	-28.6825	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	274.9431	226.7834	197.7892	138.0406	99.6687	85.6849	82.7246	103.7345	139.1550	196.8104	242.7533	271.7479	(64)
										Total per year (kWh/year) = Sum(64)m =		2059.8357	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.7023	100.0178	105.8261	90.0487	83.3081	75.2922	74.5344	77.9786	83.5690	95.6076	101.3126	111.6398	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.6046	34.2883	27.8851	21.1108	15.7806	13.3226	14.3956	18.7119	25.1151	31.8894	37.2196	39.6775	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	396.9837	401.1031	390.7223	368.6226	340.7258	314.5067	296.9907	292.8712	303.2521	325.3518	353.2486	379.4677	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)
Water heating gains (Table 5)													
	151.4815	148.8361	142.2394	125.0676	111.9733	104.5725	100.1807	104.8099	116.0680	128.5048	140.7119	150.0536	(72)
Total internal gains													
	697.3995	694.5571	671.1764	625.1307	578.8092	542.7314	521.8966	526.7227	554.7649	596.0756	641.5098	679.5285	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	19.6403	0.3900	0.0000	0.7700	56.9744	(76)
South	5.9900	46.7521	0.3900	0.0000	0.7700	84.0975	(78)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	198.9900	362.4841	545.5815	738.1134	868.2044	876.0924	839.0510	742.5229	613.7573	415.2443	242.9416	167.1499	(83)
Total gains	896.3894	1057.0412	1216.7579	1363.2441	1447.0137	1418.8239	1360.9476	1269.2456	1168.5221	1011.3199	884.4514	846.6784	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	
alpha	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	
util living area	0.9588	0.9276	0.8670	0.7591	0.6130	0.4555	0.3334	0.3718	0.5737	0.8174	0.9335	0.9659	(86)
Living	19.6203	19.9076	20.2851	20.6453	20.8708	20.9672	20.9922	20.9881	20.9233	20.5969	20.0241	19.5386	
Non living	18.5040	18.8605	19.3202	19.7406	19.9843	20.0760	20.0949	20.0927	20.0408	19.6990	19.0120	18.4018	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2942	19.9076	20.2851	20.6453	20.8708	20.9672	20.9922	20.9881	20.9233	20.5969	20.0241	19.7431	(87)
Th 2	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	(88)
util rest of house	0.9517	0.9158	0.8466	0.7256	0.5658	0.3961	0.2667	0.3015	0.5105	0.7824	0.9204	0.9598	(89)
MIT 2	19.4629	18.8605	19.3202	19.7406	19.9843	20.0760	20.0949	20.0927	20.0408	19.6990	19.0120	18.7076	(90)
Living area fraction										fLA = Living area / (4) =		0.1309	(91)
MIT	19.5717	18.9975	19.4465	19.8590	20.1004	20.1927	20.2124	20.2099	20.1563	19.8165	19.1445	18.8431	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5717	18.9975	19.4465	19.8590	20.1004	20.1927	20.2124	20.2099	20.1563	19.8165	19.1445	18.8431	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9468	0.8982	0.8297	0.7160	0.5659	0.4024	0.2752	0.3103	0.5148	0.7701	0.9033	0.9490	(94)
Useful gains	848.6849	949.4079	1009.5846	976.1371	818.8153	570.9797	374.4807	393.8010	601.4997	778.8388	798.9387	803.4947	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1592.1304	1469.7200	1349.7169	1142.5179	875.7676	583.0560	376.6023	397.1907	631.3909	960.8553	1255.6773	1526.5984	(97)
Space heating kWh	553.1234	349.6497	253.0584	119.7941	42.3725	0.0000	0.0000	0.0000	0.0000	135.4202	328.8518	537.9892	(98a)
Space heating requirement - total per year (kWh/year)												2320.2594	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	553.1234	349.6497	253.0584	119.7941	42.3725	0.0000	0.0000	0.0000	0.0000	135.4202	328.8518	537.9892	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2320.2594	
Space heating per m2											(98c) / (4) =	21.8480	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	261.1691	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	553.1234	349.6497	253.0584	119.7941	42.3725	0.0000	0.0000	0.0000	0.0000	135.4202	328.8518	537.9892	(98)
Space heating efficiency (main heating system 1)	261.1691	261.1691	261.1691	261.1691	261.1691	0.0000	0.0000	0.0000	0.0000	261.1691	261.1691	261.1691	(210)
Space heating fuel (main heating system)	211.7874	133.8786	96.8945	45.8684	16.2242	0.0000	0.0000	0.0000	0.0000	51.8515	125.9153	205.9926	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	274.9431	226.7834	197.7892	138.0406	99.6687	85.6849	82.7246	103.7345	139.1550	196.8104	242.7533	271.7479	(64)
Efficiency of water heater												183.3554	(216)
(217)m	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	(217)
Fuel for water heating, kWh/month	149.9509	123.6852	107.8720	75.2858	54.3582	46.7316	45.1171	56.5757	75.8936	107.3382	132.3950	148.2083	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	10.0995	9.1222	10.0995	9.7737	10.0995	9.7737	10.0995	10.0995	9.7737	10.0995	9.7737	10.0995	(231)
Lighting	33.7904	27.1079	24.4077	17.8821	13.8126	11.2850	12.6004	16.3784	21.2739	27.9126	31.5272	34.7295	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8086	-55.7350	-82.7495	-94.4110	-101.4220	-93.8978	-92.5924	-87.0084	-76.7467	-63.9397	-42.1388	-32.2998	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2780	-27.8450	-59.5967	-96.3610	-134.2608	-137.8159	-136.0591	-112.7656	-79.7164	-42.9062	-17.2710	-9.6141	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	888.4126	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3554	
Water heating fuel used	1123.4117	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	38.9139	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	118.9139	(231)

Electricity for lighting (calculated in Appendix L)	272.7077	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	676.2065	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	710.7300	17.5600	139.3031	(240)
Space heating - main system 1 (low-rate cost)	177.6825	0.0940	16.7022	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	786.3882	19.6000	154.1321	(245)
Low-rate cost	337.0235	9.4000	31.6802	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	38.9139	18.5800	6.4760	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	272.7077	18.5800	50.6691	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-860.7497	18.5800	-159.9273	
PV Unit electricity exported	-866.4897	5.5900	-48.4368	
Total			-208.3641	(252)
Total energy cost			212.4626	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5059	(257)
SAP value		91.8000	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	710.7300	0.1643	116.7685	(261)
Space heating - main system 1 (low-rate cost)	177.6825	0.1379	24.5073	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	786.3882	0.1528	120.1930	(264)
Water heating - low rate cost	337.0235	0.1283	43.2354	(264)
Space and water heating			304.7042	(265)
Pumps, fans and electric keep-hot	118.9139	0.1432	16.8558	(267)
Energy for lighting	272.7077	0.1490	40.6388	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-860.7497	0.1387	-119.3440	
PV Unit electricity exported	-866.4897	0.1238	-107.3051	
Total			-226.6490	(269)
Total CO2, kg/year			135.5498	(272)
CO2 emissions per m2			1.2800	(273)
EI value			98.7987	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	53.1000 (1b)	x	2.4000 (2b)	=	127.4400	(1b) - (3b)
First floor	53.1000 (1c)	x	2.6000 (2c)	=	138.0600	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.2000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	265.5000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)

Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			25.4700	0.6998	17.8250			(27)
Heatloss Floor 1			53.1000	0.1100	5.8410	75.0000	3982.5000	(28a)
External Wall 1	104.0000	27.4300	76.5700	0.1800	13.7826	60.0000	4594.2000	(29a)
External Roof 1	53.1000		53.1000	0.0900	4.7790	9.0000	477.9000	(30)
Total net area of external elements Aum(A, m2)			210.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.9716			(33)
Main dwelling								
Party Wall 1			45.0000	0.0000	0.0000	70.0000	3150.0000	(32)
Internal Wall 1			224.0000			9.0000	2016.0000	(32c)
Internal Floor 1			53.1000			18.0000	955.8000	(32d)
Internal Ceiling 1			53.1000			9.0000	477.9000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15654.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		147.4040 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.8000	0.0980	1.1564
E12 Gable (insulation at ceiling level)	9.0000	0.0970	0.8730
P1 Party wall - Ground floor	9.0000	0.3200	2.8800
P2 Party wall - Intermediate floor within a dwelling	9.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	9.0000	0.4800	4.3200
E1 Steel lintel with perforated steel base plate	14.1800	0.0500	0.7090
E3 Sill	13.2500	0.0450	0.5962
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	20.8000	0.0670	1.3936
E6 Intermediate floor within a dwelling	20.8000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		15.4744 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.4461 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	43.8075	(38)
Heat transfer coeff													
	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	104.2536	(39)
Average = Sum(39)m / 12 =												104.2536	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	0.9817	(40)
HLP (average)												0.9817	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7900 (42)
Hot water usage for mixer showers		
	70.9987 69.9317 68.3770 65.4022 63.2068 60.7586 59.3670 60.9101 62.6015 65.2301 68.2688 70.7267	(42a)
Hot water usage for baths		
	30.6550 30.1997 29.5586 28.3765 27.4914 26.5099 25.9797 26.6164 27.3095 28.3598 29.5662 30.5514	(42b)
Hot water usage for other uses		
	43.2023 41.6313 40.0603 38.4893 36.9183 35.3473 35.3473 36.9183 38.4893 40.0603 41.6313 43.2023	(42c)
Average daily hot water use (litres/day)		133.1552 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	144.8560	141.7627	137.9958	132.2680	127.6165	122.6158	120.6941	124.4447	128.4003	133.6502	139.4663	144.4803	(44)
Energy conte	229.4165	201.8683	212.0945	181.0682	171.7963	150.7704	145.9690	154.0886	158.3304	181.3620	198.6953	226.2213	(45)
Energy content (annual)										Total = Sum(45)m =		2211.6808	
Distribution loss (46)m = 0.15 x (45)m													
	34.4125	30.2802	31.8142	27.1602	25.7694	22.6156	21.8954	23.1133	23.7496	27.2043	29.8043	33.9332	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	274.9431	242.9891	256.2253	218.3726	204.5286	182.2217	178.4687	187.5187	196.9856	225.4929	242.7533	271.7479	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.8000	(H2)
Collector linear heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0000	(H4)
Collector loop efficiency	0.9000	(H5)
Incidence angle modifier	1.0000	(H6)
Overshading factor	0.8000	(H8)
Overall heat loss coefficient of system	6.5000	(H10)
Heat loss coefficient of collector loop	3.9667	(H11)
Dedicated solar storage volume	75.0000	(H12)
Effective solar volume	75.0000	(H14)
Reference volume	225.0000	(H15)
Storage tank correction coefficient	1.3161	(H16)
Heat delivered to hot water	783.4306	(H24)
Heat delivered to space heating	0.0000	(H29)
Solar input	783.4306	

Solar input	-6.3509	-24.0124	-70.0063	-96.3519	-118.3207	-116.5437	-115.9438	-104.1463	-76.3302	-44.7909	-10.6336	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	268.5921	218.9767	186.2191	122.0207	86.2079	65.6780	62.5249	83.3725	120.6554	180.7020	232.1198	271.7479	(64)

Total per year (kWh/year) = Sum(64)m = 1898.8168 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	112.7023	100.0178	105.8261	90.0487	83.3081	75.2922	74.5344	77.9786	83.5690	95.6076	101.3126	111.6398	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	167.3993	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	38.6046	34.2883	27.8851	21.1108	15.7806	13.3226	14.3956	18.7119	25.1151	31.8894	37.2196	39.6775	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	396.9837	401.1031	390.7223	368.6226	340.7258	314.5067	296.9907	292.8712	303.2521	325.3518	353.2486	379.4677	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	54.5299	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	-111.5995	(71)

Water heating gains (Table 5)

	151.4815	148.8361	142.2394	125.0676	111.9733	104.5725	100.1807	104.8099	116.0680	128.5048	140.7119	150.0536	(72)

Total internal gains

	697.3995	694.5571	671.1764	625.1307	578.8092	542.7314	521.8966	526.7227	554.7649	596.0756	641.5098	679.5285	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.6600	26.6540	0.3900	0.0000	0.7700	77.3206	(76)
South	5.9900	59.9148	0.3900	0.0000	0.7700	107.7746	(78)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	263.6965	405.7439	603.3607	838.2354	953.0864	1029.6753	989.7391	877.4036	728.6679	495.9215	310.1888	220.8235	(83)
Total gains	961.0960	1100.3011	1274.5371	1463.3661	1531.8957	1572.4068	1511.6357	1404.1263	1283.4328	1091.9971	951.6986	900.3520	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	41.7100	
alpha	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	3.7807	
util living area													
	0.9402	0.9083	0.8307	0.6898	0.5181	0.3407	0.2269	0.2441	0.4491	0.7271	0.8943	0.9483	(86)
Living	19.8524	20.0676	20.4381	20.7687	20.9368	20.9900	20.9985	20.9980	20.9721	20.7742	20.2924	19.8072	
Non living	18.7946	19.0579	19.5019	19.8757	20.0480	20.0930	20.0982	20.0980	20.0810	19.8931	19.3400	18.7397	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4129	20.0676	20.4381	20.7687	20.9368	20.9900	20.9985	20.9980	20.9721	20.7742	20.2924	19.9740	(87)
Th 2	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	20.0986	(88)
util rest of house													
	0.9297	0.8933	0.8056	0.6507	0.4666	0.2832	0.1653	0.1779	0.3830	0.6795	0.8737	0.9389	(89)
MIT 2	19.5788	19.0579	19.5019	19.8757	20.0480	20.0930	20.0982	20.0980	20.0810	19.8931	19.3400	18.9846	(90)
Living area fraction											fLA = Living area / (4) =	0.1309	(91)
MIT	19.6879	19.1901	19.6244	19.9926	20.1643	20.2104	20.2160	20.2158	20.1977	20.0084	19.4647	19.1141	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6879	19.1901	19.6244	19.9926	20.1643	20.2104	20.2160	20.2158	20.1977	20.0084	19.4647	19.1141	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9242	0.8754	0.7908	0.6459	0.4705	0.2904	0.1733	0.1865	0.3904	0.6743	0.8565	0.9262	(94)
Useful gains	888.2592	963.2193	1007.8948	945.1189	720.7419	456.6792	262.0136	261.9081	501.0549	736.3553	815.1238	833.9044	(95)

Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1499.9953	1406.3899	1274.4362	1052.1862	746.9064	459.8033	262.3023	262.2834	510.5993	834.9083	1143.1068	1419.3207	(97)
Space heating kWh	455.1316	297.8106	198.3068	77.0884	19.4664	0.0000	0.0000	0.0000	0.0000	73.3234	236.1478	435.5497	(98a)
Space heating requirement - total per year (kWh/year)												1792.8248	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	455.1316	297.8106	198.3068	77.0884	19.4664	0.0000	0.0000	0.0000	0.0000	73.3234	236.1478	435.5497	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1792.8248	
Space heating per m2											(98c) / (4) =	16.8816	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												261.1691	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	455.1316	297.8106	198.3068	77.0884	19.4664	0.0000	0.0000	0.0000	0.0000	73.3234	236.1478	435.5497	(98)
Space heating efficiency (main heating system 1)	261.1691	261.1691	261.1691	261.1691	261.1691	0.0000	0.0000	0.0000	0.0000	261.1691	261.1691	261.1691	(210)
Space heating fuel (main heating system)	174.2670	114.0298	75.9304	29.5167	7.4535	0.0000	0.0000	0.0000	0.0000	28.0751	90.4195	166.7692	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	268.5921	218.9767	186.2191	122.0207	86.2079	65.6780	62.5249	83.3725	120.6554	180.7020	232.1198	271.7479	(64)
Efficiency of water heater												183.3554	(216)
(217)m	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	183.3554	(217)
Fuel for water heating, kWh/month	146.4872	119.4275	101.5618	66.5487	47.0169	35.8201	34.1004	45.4704	65.8041	98.5529	126.5956	148.2083	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	10.0995	9.1222	10.0995	9.7737	10.0995	9.7737	10.0995	10.0995	9.7737	10.0995	9.7737	10.0995	(231)
Lighting	33.7904	27.1079	24.4077	17.8821	13.8126	11.2850	12.6004	16.3784	21.2739	27.9126	31.5272	34.7295	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.7223	-60.6392	-88.1207	-100.6376	-105.3603	-100.9604	-99.7052	-94.5622	-84.8661	-71.6719	-50.9035	-40.8182	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.9475	-33.3825	-70.1395	-117.0875	-154.4482	-172.3839	-171.0700	-142.6043	-101.8709	-56.5945	-25.3028	-14.7919	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												686.4612	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.3554	
Water heating fuel used												1035.5938	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												38.9139	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												118.9139	(231)
Electricity for lighting (calculated in Appendix L)												272.7077	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2024.5910	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												89.0856	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	549.1690	27.8600	171.3407	(240)
Space heating - main system 1 (low-rate cost)	137.2922	0.1450	19.9074	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	724.9156	31.2000	226.1737	(245)
Low-rate cost	310.6781	14.5000	45.0483	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	38.9139	29.5300	10.2565	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	272.7077	29.5300	80.5306	(250)
Additional standing charges			3.0000	(251)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-945.9676	29.5300	-279.3442	
PV Unit electricity exported	-1078.6234	5.8100	-62.6680	
Total			-342.0122	(252)
Total energy cost			237.8690	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	549.1690	0.1653	90.7649	(261)
Space heating - main system 1 (low-rate cost)	137.2922	0.1387	19.0485	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	724.9156	0.1541	111.7408	(264)
Water heating - low rate cost	310.6781	0.1294	40.1964	(264)
Space and water heating			261.7505	(265)
Pumps, fans and electric keep-hot	118.9139	0.1432	16.8558	(267)
Energy for lighting	272.7077	0.1490	40.6388	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-945.9676	0.1391	-131.5978	
PV Unit electricity exported	-1078.6234	0.1239	-133.6483	
Total			-265.2462	(269)
Total CO2, kg/year			53.9990	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	549.1690	1.2927	887.3608	(275)
Space heating - main system 1 (low-rate cost)	137.2922	1.5028	206.3194	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	724.9156	1.5755	1142.0909	(278)
Water heating - low rate cost	310.6781	1.4653	455.2318	(278)
Space and water heating			2691.0029	(279)
Pumps, fans and electric keep-hot	118.9139	1.5335	181.5538	(281)
Energy for lighting	272.7077	1.5547	423.9908	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-945.9676	1.5186	-1436.5089	
PV Unit electricity exported	-1078.6234	0.4546	-490.3702	
Total			-1926.8791	(283)
Total Primary energy kWh/year			1369.6684	(286)

Full SAP Calculation Printout

Property Reference	HT 8 Havant	**Issued on Date**	22/06/2025
Assessment Reference	2B3P ASHP	**Prop Type Ref**	2B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.94	**TER**	13.50
Environmental	96 A	**% DER < TER**			63.41
CO_2 Emissions (t/year)	0.27	**DFEE**	36.85	**TFEE**	40.45
Compliance Check	See BREL	**% DFEE < TFEE**			8.90
% DPER < TPER	26.63	**DPER**	51.93	**TPER**	70.78

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900 (1b)	x	2.4000 (2b)	=	73.4160	(1b) - (3b)
First floor	30.5900 (1c)	x	2.6000 (2c)	=	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.9500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11800.8900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	192.8880	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E10	Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153
E12	Gable (insulation at ceiling level)	6.5400	0.0970	0.6344
P1	Party wall - Ground floor	6.5400	0.3200	2.0928
P2	Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392
E1	Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3	Sill	8.3000	0.0450	0.3735
E4	Jamb	31.5000	0.0510	1.6065
E5	Ground floor (normal)	15.9000	0.0670	1.0653
E6	Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16	Corner (normal)	10.0000	0.0570	0.5700
E18	Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4785 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.7669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	(38)
Heat transfer coeff	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	(39)

Average = Sum(39)m / 12 = 69.0036

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	(40)
HLP (average)												1.1279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0148 (42)

Hot water usage for mixer showers

58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)

Hot water usage for baths

25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)

Hot water usage for other uses

35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)

Average daily hot water use (litres/day) 108.7725 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)

Energy content (annual) Total = Sum(45)m = 1806.6883

Distribution loss (46)m = 0.15 x (45)m

28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(64)

Total per year (kWh/year) = Sum(64)m = 2342.7273 (64)

12Total per year (kWh/year) 2343 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

98.7338	87.7270	94.0294	84.4273	83.0839	76.1981	76.0687	78.2739	78.2510	85.6815	89.2146	97.8659	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.7278	98.2344	88.7278	91.6854	88.7278	91.6854	88.7278	88.7278	91.6854	88.7278	91.6854	88.7278	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.9128	177.7382	173.1382	163.3453	150.9836	139.3653	131.6036	129.7781	134.3781	144.1710	156.5328	168.1511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)	132.7067	130.5461	126.3836	117.2602	111.6719	105.8307	102.2428	105.2068	108.6819	115.1633	123.9092	131.5401	(72)
Total internal gains	450.5692	459.7406	441.4716	425.5128	404.6052	390.1033	375.7961	376.9347	387.9674	401.2841	425.3493	441.6409	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)

West			7.0400		19.6403		0.3900		0.0000		0.7700		41.5217 (80)
Solar gains	96.3139	188.4104	310.2850	452.5322	554.5952	567.7269	540.4991	464.2808	360.8743	223.5648	120.0921	79.2038	(83)
Total gains	546.8831	648.1509	751.7566	878.0450	959.2004	957.8302	916.2953	841.2154	748.8417	624.8488	545.4414	520.8448	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	
alpha	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	
util living area	0.9760	0.9530	0.9021	0.7856	0.6216	0.4510	0.3291	0.3733	0.5970	0.8579	0.9566	0.9800	(86)
Living	19.6706	19.9400	20.3072	20.6882	20.9022	20.9793	20.9956	20.9926	20.9375	20.6098	20.0601	19.6058	
Non living	18.4582	18.7937	19.2411	19.6787	19.8992	19.9660	19.9765	19.9752	19.9365	19.6071	18.9492	18.3767	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3199	19.9400	20.3072	20.6882	20.9022	20.9793	20.9956	20.9926	20.9375	20.6098	20.0601	19.8008	(87)
Th 2	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	(88)
util rest of house	0.9703	0.9426	0.8816	0.7469	0.5657	0.3828	0.2538	0.2923	0.5215	0.8203	0.9451	0.9753	(89)
MIT 2	19.3722	18.7937	19.2411	19.6787	19.8992	19.9660	19.9765	19.9752	19.9365	19.6071	18.9492	18.6653	(90)
Living area fraction										fLA = Living area / (4) =		0.2228	(91)
MIT	19.5833	19.0491	19.4786	19.9036	20.1227	20.1917	20.2036	20.2019	20.1596	19.8305	19.1967	18.9183	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5833	19.0491	19.4786	19.9036	20.1227	20.1917	20.2036	20.2019	20.1596	19.8305	19.1967	18.9183	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9677	0.9307	0.8699	0.7439	0.5739	0.3973	0.2705	0.3102	0.5355	0.8141	0.9338	0.9689	(94)
Useful gains	529.2283	603.2242	653.9665	653.1410	550.4958	380.5892	247.8680	260.9345	401.0022	508.6972	509.3353	504.6315	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1054.6058	976.3389	895.5710	759.2864	581.1956	385.8501	248.6592	262.3436	418.1309	636.9382	834.7136	1015.6125	(97)
Space heating kWh	390.8809	250.7331	179.7537	76.4248	22.8406	0.0000	0.0000	0.0000	0.0000	95.4113	234.2723	380.1699	(98a)
Space heating requirement - total per year (kWh/year)												1630.4867	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	390.8809	250.7331	179.7537	76.4248	22.8406	0.0000	0.0000	0.0000	0.0000	95.4113	234.2723	380.1699	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1630.4867	
Space heating per m2										(98c) / (4) =		26.6506	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 272.6120 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	390.8809	250.7331	179.7537	76.4248	22.8406	0.0000	0.0000	0.0000	0.0000	95.4113	234.2723	380.1699	(98)
Space heating efficiency (main heating system 1)	272.6120	272.6120	272.6120	272.6120	272.6120	0.0000	0.0000	0.0000	0.0000	272.6120	272.6120	272.6120	(210)
Space heating fuel (main heating system)	143.3836	91.9744	65.9376	28.0343	8.3784	0.0000	0.0000	0.0000	0.0000	34.9989	85.9362	139.4546	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(64)
Efficiency of water heater												185.2700	(216)
(217)m	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	(217)
Fuel for water heating, kWh/month	125.7260	111.2021	118.0894	103.6166	100.3213	90.2581	88.9334	92.5131	93.5905	104.5381	111.3880	124.3172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	1.9040	1.7197	1.9040	1.8425	1.9040	1.8425	1.9040	1.9040	1.8425	1.9040	1.8425	1.9040	(231)
Lighting	21.5207	17.2647	15.5450	11.3889	8.7971	7.1873	8.0250	10.4312	13.5492	17.7772	20.0793	22.1189	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												598.0979	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	185.2700	
Water heating fuel used	1264.4939	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	22.4176	(230a)
Total electricity for the above, kWh/year	22.4176	(231)
Electricity for lighting (calculated in Appendix L)	173.6847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2058.6941	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	478.4783	0.1645	78.7017	(261)
Space heating - main system 1 (low-rate cost)	119.6196	0.1381	16.5178	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	885.1457	0.1479	130.8793	(264)
Water heating - low rate cost	379.3482	0.1241	47.0759	(264)
Space and water heating			273.1747	(265)
Pumps, fans and electric keep-hot	22.4176	0.1432	3.1106	(267)
Energy for lighting	173.6847	0.1490	25.8825	(268)
Total CO2, kg/year			302.1677	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	478.4783	1.2904	771.7804	(275)
Space heating - main system 1 (low-rate cost)	119.6196	1.5001	179.4473	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	885.1457	1.5527	1374.3791	(278)
Water heating - low rate cost	379.3482	1.4441	547.8077	(278)
Space and water heating			2873.4145	(279)
Pumps, fans and electric keep-hot	22.4176	1.5335	33.9169	(281)
Energy for lighting	173.6847	1.5547	270.0354	(282)
Total Primary energy kWh/year			3177.3667	(286)
Dwelling Primary energy Rate (DPER)			51.9300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900	(1b) x	2.4000	(2b) =	73.4160	(1b) - (3b)
First floor	30.5900	(1c) x	2.6000	(2c) =	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		152.9500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1308	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3808	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3236	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4127	0.4046	0.3965	0.3560	0.3479	0.3075	0.3075	0.2994	0.3236	0.3479	0.3641	0.3803 (22b)
Effective ac	0.5851	0.5818	0.5786	0.5634	0.5605	0.5473	0.5473	0.5448	0.5524	0.5605	0.5663	0.5723 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			13.3400	1.1450	15.2748			(27)
Heatloss Floor 1			39.5000	0.1300	5.1350			(28a)
External Wall 1	79.5000	15.3000	64.2000	0.1800	11.5560			(29a)
External Roof 1	30.5900		30.5900	0.1100	3.3649			(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.2907			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.8880 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.3400	0.0600	0.5604	
E12 Gable (insulation at ceiling level)	6.5400	0.0600	0.3924	
P1 Party wall - Ground floor	6.5400	0.0800	0.5232	
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.1200	0.7848	
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615	
E3 Sill	8.3000	0.0500	0.4150	
E4 Jamb	31.5000	0.0500	1.5750	
E5 Ground floor (normal)	15.9000	0.1600	2.5440	
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7563 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 46.0470 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.5341	29.3672	29.2036	28.4354	28.2916	27.6225	27.6225	27.4986	27.8802	28.2916	28.5824	28.8864	(38)
Heat transfer coeff	75.5811	75.4142	75.2506	74.4824	74.3386	73.6695	73.6695	73.5456	73.9272	74.3386	74.6294	74.9334	(39)
Average = Sum(39)m / 12 =												74.4817	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2354	1.2327	1.2300	1.2174	1.2151	1.2041	1.2041	1.2021	1.2084	1.2151	1.2198	1.2248	(40)
HLP (average)												1.2174	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0148 (42)

Hot water usage for mixer showers

58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)

Hot water usage for baths

25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)

Hot water usage for other uses

35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)

Average daily hot water use (litres/day) 108.7725 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)
Energy content (annual)										Total = Sum(45)m =		1806.6883	

Distribution loss (46)m = 0.15 x (45)m

28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

239.1526	211.6421	225.0041	197.9899	192.0853	173.2404	170.9869	177.6191	179.4145	199.8977	212.3878	236.5423	(62)
WWHRS -26.5157	-23.4507	-24.5562	-20.3335	-18.9501	-16.2157	-15.1997	-16.1633	-16.7774	-19.7787	-22.4069	-26.0246	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

212.6369	188.1914	200.4480	177.6564	173.1352	157.0247	155.7872	161.4558	162.6371	180.1190	189.9810	210.5177	(64)
								Total per year (kWh/year) = Sum(64)m =			2169.5903	(64)

12Total per year (kWh/year) 2170 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

103.7098	92.2214	99.0054	89.2428	88.0599	81.0136	81.0447	83.2499	83.0665	90.6575	94.0301	102.8419	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
88.7867 98.2996 88.7867 91.7463 88.7867 91.7463 88.7867 88.7867 91.7463 88.7867 91.7463 88.7867 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
175.9128 177.7382 173.1382 163.3453 150.9836 139.3653 131.6036 129.7781 134.3781 144.1710 156.5328 168.1511 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 33.0740 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 -80.5917 (71)
Water heating gains (Table 5)
139.3948 137.2342 133.0718 123.9483 118.3601 112.5189 108.9310 111.8950 115.3701 121.8515 130.5974 138.2283 (72)
Total internal gains
460.3163 469.4939 451.2186 435.2618 414.3523 396.8523 382.5432 383.6817 394.7164 411.0311 435.0983 451.3880 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.5900	19.6403	0.6300	0.7000	0.7700	45.5576	(76)
West	5.7500	19.6403	0.6300	0.7000	0.7700	34.5133	(80)

Solar gains 80.0709 156.6358 257.9568 376.2146 461.0651 471.9822 449.3463 385.9818 300.0144 185.8615 99.8391 65.8465 (83)
Total gains 540.3872 626.1297 709.1754 811.4764 875.4174 868.8345 831.8894 769.6635 694.7308 596.8927 534.9374 517.2344 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.3710	43.4669	43.5614	44.0107	44.0958	44.4964	44.4964	44.5713	44.3412	44.0958	43.9240	43.7458	
alpha	3.8914	3.8978	3.9041	3.9340	3.9397	3.9664	3.9664	3.9714	3.9561	3.9397	3.9283	3.9164	
util living area	0.9786	0.9619	0.9259	0.8369	0.6946	0.5196	0.3839	0.4300	0.6609	0.8860	0.9627	0.9817	(86)
MIT	19.4610	19.7151	20.0872	20.5320	20.8244	20.9576	20.9900	20.9844	20.8924	20.4851	19.9000	19.4201	(87)
Th 2	19.8918	19.8940	19.8961	19.9061	19.9080	19.9167	19.9167	19.9183	19.9133	19.9080	19.9042	19.9002	(88)
util rest of house	0.9734	0.9528	0.9086	0.8014	0.6358	0.4401	0.2921	0.3332	0.5797	0.8519	0.9522	0.9772	(89)
MIT 2	18.1349	18.4547	18.9155	19.4479	19.7630	19.8915	19.9130	19.9121	19.8401	19.4117	18.6985	18.0891	(90)
Living area fraction									fLA = Living area / (4) =			0.2228	(91)
MIT	18.4303	18.7355	19.1766	19.6894	19.9994	20.1290	20.1530	20.1510	20.0746	19.6508	18.9662	18.3856	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4303	18.7355	19.1766	19.6894	19.9994	20.1290	20.1530	20.1510	20.0746	19.6508	18.9662	18.3856	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9405	0.8948	0.7934	0.6410	0.4562	0.3124	0.3545	0.5926	0.8423	0.9404	0.9685	(94)
Useful gains	520.8471	588.8640	634.5578	643.8509	561.1626	396.3426	259.9119	272.8449	411.6957	502.7702	503.0388	500.9515	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1067.9847	1043.3945	953.9193	803.6231	616.9685	407.3181	261.7455	275.8715	441.6842	672.8266	885.5692	1062.9758	(97)
Space heating kWh	407.0704	305.4445	237.6050	115.0360	41.5196	0.0000	0.0000	0.0000	0.0000	126.5219	275.4219	418.1461	(98a)
Space heating requirement - total per year (kWh/year)												1926.7654	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	407.0704	305.4445	237.6050	115.0360	41.5196	0.0000	0.0000	0.0000	0.0000	126.5219	275.4219	418.1461	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1926.7654	
Space heating per m2											(98c) / (4) =	31.4934	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	407.0704	305.4445	237.6050	115.0360	41.5196	0.0000	0.0000	0.0000	0.0000	126.5219	275.4219	418.1461	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	441.0297	330.9258	257.4268	124.6327	44.9833	0.0000	0.0000	0.0000	0.0000	137.0769	298.3986	453.0293	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	212.6369	188.1914	200.4480	177.6564	173.1352	157.0247	155.7872	161.4558	162.6371	180.1190	189.9810	210.5177	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.4916	85.1393	84.4421	83.1106	81.3957	79.8000	79.8000	79.8000	79.8000	83.2827	84.8917	85.5684	(217)
Fuel for water heating, kWh/month	248.7225	221.0394	237.3791	213.7589	212.7081	196.7728	195.2221	202.3255	203.8058	216.2741	223.7921	246.0228	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	18.4481	14.7998	13.3256	9.7629	7.5411	6.1612	6.8793	8.9419	11.6147	15.2391	17.2125	18.9609	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.9080	-40.9070	-59.0355	-66.6789	-72.1905	-67.5218	-66.7142	-62.8486	-56.0552	-46.9345	-31.8447	-24.9770	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-15.8818	-33.4586	-66.5790	-100.0987	-132.4366	-133.0670	-131.4750	-111.2630	-81.4954	-47.8540	-21.2092	-12.5532	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2087.5032	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2617.8234	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	148.8869	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1511.9874	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3428.2261	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2087.5032	0.2100	438.3757	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2617.8234	0.2100	549.7429	(264)
Space and water heating			988.1186	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	148.8869	0.1443	21.4890	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.6159	0.1345	-84.0023	
PV Unit electricity exported	-887.3715	0.1259	-111.6947	
Total			-195.6970	(269)
Total CO2, kg/year			825.8398	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			13.5000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2087.5032	1.1300	2358.8786	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2617.8234	1.1300	2958.1404	(278)
Space and water heating			5317.0190	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	148.8869	1.5338	228.3677	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-624.6159	1.4970	-935.0707	
PV Unit electricity exported	-887.3715	0.4620	-409.9957	
Total			-1345.0664	(283)
Total Primary energy kWh/year			4330.4211	(286)
Target Primary Energy Rate (TPER)			70.7800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900 (1b)	x	2.4000 (2b)	=	73.4160	(1b) - (3b)
First floor	30.5900 (1c)	x	2.6000 (2c)	=	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.9500	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1308	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3308	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2811	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3585	0.3514	0.3444	0.3093	0.3022	0.2671	0.2671	0.2601	0.2811	0.3022	0.3163	0.3303	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0.0000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5642	0.5618	0.5593	0.5478	0.5457	0.5357	0.5357	0.5338	0.5395	0.5457	0.5500	0.5546	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11800.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.8880 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E10 Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153	
E12 Gable (insulation at ceiling level)	6.5400	0.0970	0.6344	
P1 Party wall - Ground floor	6.5400	0.3200	2.0928	
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392	
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615	
E3 Sill	8.3000	0.0450	0.3735	
E4 Jamb	31.5000	0.0510	1.6065	
E5 Ground floor (normal)	15.9000	0.0670	1.0653	
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0570	0.5700	
E18 Party wall between dwellings	10.0000	0.0620	0.6200	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4785 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.7669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	28.4796	28.3536	28.2302	27.6505	27.5420	27.0371	27.0371	26.9436	27.2316	27.5420	27.7614	27.9908	(38)
Heat transfer coeff	72.2464	72.1205	71.9971	71.4173	71.3089	70.8039	70.8039	70.7104	70.9984	71.3089	71.5283	71.7577	(39)

Average = Sum(39)m / 12 = 71.4168

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1809	1.1788	1.1768	1.1673	1.1656	1.1573	1.1573	1.1558	1.1605	1.1656	1.1691	1.1729	(40)
HLP (average)												1.1673	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0148 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)

Hot water usage for other uses

35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)

Average daily hot water use (litres/day) 55.2975 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	60.3291	58.6745	56.8680	54.6191	52.6130	50.5282	50.0947	51.8976	53.7467	55.8877	58.1565	60.2443	(44)
Energy conte	95.5465	83.5517	87.4040	74.7708	70.8273	62.1303	60.5852	64.2601	66.2750	75.8391	82.8546	94.3281	(45)

Energy content (annual) Total = Sum(45)m = 918.3727

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	81.2145	71.0190	74.2934	63.5552	60.2032	52.8108	51.4974	54.6210	56.3338	64.4632	70.4264	80.1789	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	81.2145	71.0190	74.2934	63.5552	60.2032	52.8108	51.4974	54.6210	56.3338	64.4632	70.4264	80.1789	(64)
											Total per year (kWh/year) = Sum(64)m =	780.6168	(64)
12Total per year (kWh/year)												781	(64)
Electric shower(s)													
	46.4492	41.3866	45.1926	43.1267	43.9360	41.9107	43.3077	43.9360	43.1267	45.1926	44.3428	46.4492	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												528.3566	(64a)
Heat gains from water heating, kWh/month													
	31.9159	28.1014	29.8715	26.6705	26.0348	23.6804	23.7013	24.6393	24.8651	27.4140	28.6923	31.6570	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	88.7278	98.2344	88.7278	91.6854	88.7278	91.6854	88.7278	88.7278	91.6854	88.7278	91.6854	88.7278	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	175.9128	177.7382	173.1382	163.3453	150.9836	139.3653	131.6036	129.7781	134.3781	144.1710	156.5328	168.1511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)													
	42.8978	41.8175	40.1498	37.0423	34.9930	32.8894	31.8566	33.1173	34.5349	36.8467	39.8504	42.5497	(72)
Total internal gains													
	360.7603	371.0120	355.2378	345.2950	327.9263	317.1620	305.4098	304.8451	313.8203	322.9675	341.2905	352.6505	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	96.3139	188.4104	310.2850	452.5322	554.5952	567.7269	540.4991	464.2808	360.8743	223.5648	120.0921	79.2038	(83)
Total gains	457.0742	559.4224	665.5228	797.8272	882.5215	884.8889	845.9090	769.1259	674.6947	546.5322	461.3826	431.8544	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.3728	45.4521	45.5300	45.8996	45.9694	46.2972	46.2972	46.3584	46.1704	45.9694	45.8284	45.6819	
alpha	4.0249	4.0301	4.0353	4.0600	4.0646	4.0865	4.0865	4.0906	4.0780	4.0646	4.0552	4.0455	
util living area													
	0.9874	0.9720	0.9343	0.8330	0.6750	0.4953	0.3643	0.4156	0.6590	0.9033	0.9757	0.9899	(86)
MIT	19.3962	19.6882	20.1026	20.5750	20.8562	20.9683	20.9929	20.9880	20.9034	20.4717	19.8415	19.3447	(87)
Th 2	19.9353	19.9370	19.9386	19.9462	19.9477	19.9543	19.9543	19.9555	19.9517	19.9477	19.9448	19.9417	(88)
util rest of house													
	0.9842	0.9651	0.9187	0.7978	0.6174	0.4207	0.2796	0.3246	0.5800	0.8733	0.9686	0.9873	(89)
MIT 2	18.4917	18.7800	19.1816	19.6217	19.8555	19.9396	19.9523	19.9518	19.9002	19.5443	18.9400	18.4456	(90)
Living area fraction										fLA = Living area / (4) =		0.2228	(91)
MIT	18.6932	18.9823	19.3868	19.8341	20.0785	20.1688	20.1841	20.1826	20.1237	19.7509	19.1408	18.6459	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6932	18.9823	19.3868	19.8341	20.0785	20.1688	20.1841	20.1826	20.1237	19.7509	19.1408	18.6459	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9792	0.9573	0.9089	0.7937	0.6250	0.4364	0.2985	0.3447	0.5938	0.8666	0.9614	0.9829	(94)
Useful gains	447.5520	535.5128	604.9227	633.2069	551.5677	386.1238	252.4692	265.1430	400.6041	473.6412	443.5789	424.4723	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1039.8594	1015.6229	927.8089	780.8808	597.4593	394.2932	253.7686	267.4726	427.6728	652.5408	861.2597	1036.6050	(97)
Space heating kWh													
	440.6767	322.6340	240.2273	106.3252	34.1434	0.0000	0.0000	0.0000	0.0000	133.1014	300.7302	455.4268	(98a)
Space heating requirement - total per year (kWh/year)												2033.2649	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	440.6767	322.6340	240.2273	106.3252	34.1434	0.0000	0.0000	0.0000	0.0000	133.1014	300.7302	455.4268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2033.2649	
Space heating per m2											(98c) / (4) =	33.2341	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

	0.0000	0.0000	0.0000	0.0000	0.0000	665.5569	523.9491	537.3992	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9278	0.9596	0.9417	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	617.5314	502.7945	506.0464	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1001.6369	957.8200	869.7850	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	276.5560	338.5390	270.6216	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	69.1390	84.6347	67.6554	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												221.4291	(107)
Energy for space heating												33.2341	(99)
Energy for space cooling												3.6193	(108)
Total												36.8534	(109)
Fabric Energy Efficiency (DFEE)												36.9	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900 (1b)	x	2.4000 (2b)	=	73.4160	(1b) - (3b)
First floor	30.5900 (1c)	x	2.6000 (2c)	=	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.9500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1308	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3808	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3236	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4127	0.4046	0.3965	0.3560	0.3479	0.3075	0.3075	0.2994	0.3236	0.3479	0.3641	0.3803	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5851	0.5818	0.5786	0.5634	0.5605	0.5473	0.5473	0.5448	0.5524	0.5605	0.5663	0.5723	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			13.3400	1.1450	15.2748			(27)
Heatloss Floor 1			39.5000	0.1300	5.1350			(28a)
External Wall 1	79.5000	15.3000	64.2000	0.1800	11.5560			(29a)
External Roof 1	30.5900		30.5900	0.1100	3.3649			(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.2907			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	192.8880 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3400	0.0600	0.5604
E12 Gable (insulation at ceiling level)	6.5400	0.0600	0.3924
P1 Party wall - Ground floor	6.5400	0.0800	0.5232
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.1200	0.7848
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3 Sill	8.3000	0.0500	0.4150
E4 Jamb	31.5000	0.0500	1.5750
E5 Ground floor (normal)	15.9000	0.1600	2.5440
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000

E18 Party wall between dwellings									10.0000	0.0600	0.6000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												8.7563	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		46.0470	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.5341	29.3672	29.2036	28.4354	28.2916	27.6225	27.6225	27.4986	27.8802	28.2916	28.5824	28.8864	(38)
Heat transfer coeff	75.5811	75.4142	75.2506	74.4824	74.3386	73.6695	73.6695	73.5456	73.9272	74.3386	74.6294	74.9334	(39)
Average = Sum(39)m / 12 =												74.4817	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2354	1.2327	1.2300	1.2174	1.2151	1.2041	1.2041	1.2021	1.2084	1.2151	1.2198	1.2248	(40)
HLP (average)												1.2174	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0148	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)
Hot water usage for other uses	35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)
Average daily hot water use (litres/day)												55.2975	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	60.3291	58.6745	56.8680	54.6191	52.6130	50.5282	50.0947	51.8976	53.7467	55.8877	58.1565	60.2443	(44)
Energy conte	95.5465	83.5517	87.4040	74.7708	70.8273	62.1303	60.5852	64.2601	66.2750	75.8391	82.8546	94.3281	(45)
Energy content (annual)											Total = Sum(45)m =	918.3727	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	81.2145	71.0190	74.2934	63.5552	60.2032	52.8108	51.4974	54.6210	56.3338	64.4632	70.4264	80.1789	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	81.2145	71.0190	74.2934	63.5552	60.2032	52.8108	51.4974	54.6210	56.3338	64.4632	70.4264	80.1789	(64)
										Total per year (kWh/year) = Sum(64)m =		780.6168	(64)
12Total per year (kWh/year)												781	(64)
Electric shower(s)	46.4492	41.3866	45.1926	43.1267	43.9360	41.9107	43.3077	43.9360	43.1267	45.1926	44.3428	46.4492	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		528.3566	(64a)
Heat gains from water heating, kWh/month	31.9159	28.1014	29.8715	26.6705	26.0348	23.6804	23.7013	24.6393	24.8651	27.4140	28.6923	31.6570	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	100.7397	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	88.7867	98.2996	88.7867	91.7463	88.7867	91.7463	88.7867	88.7867	91.7463	88.7867	91.7463	88.7867	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	175.9128	177.7382	173.1382	163.3453	150.9836	139.3653	131.6036	129.7781	134.3781	144.1710	156.5328	168.1511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	33.0740	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)	42.8978	41.8175	40.1498	37.0423	34.9930	32.8894	31.8566	33.1173	34.5349	36.8467	39.8504	42.5497	(72)
Total internal gains	360.8192	371.0772	355.2967	345.3558	327.9852	317.2228	305.4687	304.9040	313.8812	323.0263	341.3513	352.7094	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	7.5900	19.6403	0.6300	0.7000	0.7700	45.5576	(76)
West	5.7500	19.6403	0.6300	0.7000	0.7700	34.5133	(80)

Solar gains	80.0709	156.6358	257.9568	376.2146	461.0651	471.9822	449.3463	385.9818	300.0144	185.8615	99.8391	65.8465	(83)
Total gains	440.8901	527.7130	613.2535	721.5704	789.0503	789.2050	754.8150	690.8858	613.8956	508.8879	441.1904	418.5559	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.3710	43.4669	43.5614	44.0107	44.0958	44.4964	44.4964	44.5713	44.3412	44.0958	43.9240	43.7458	
alpha	3.8914	3.8978	3.9041	3.9340	3.9397	3.9664	3.9664	3.9714	3.9561	3.9397	3.9283	3.9164	
util living area													

	0.9891	0.9777	0.9509	0.8752	0.7418	0.5636	0.4207	0.4746	0.7185	0.9247	0.9797	0.9910	(86)
MIT	19.2664	19.5339	19.9327	20.4318	20.7764	20.9437	20.9861	20.9780	20.8543	20.3622	19.7258	19.2246	(87)
Th 2	19.8918	19.8940	19.8961	19.9061	19.9080	19.9167	19.9167	19.9183	19.9133	19.9080	19.9042	19.9002	(88)
util rest of house													
	0.9862	0.9720	0.9384	0.8448	0.6848	0.4803	0.3212	0.3698	0.6383	0.8990	0.9736	0.9887	(89)
MIT 2	18.3313	18.5967	18.9872	19.4633	19.7607	19.8900	19.9127	19.9113	19.8333	19.4138	18.7965	18.2961	(90)
Living area fraction										fLA = Living area / (4) =		0.2228	(91)
MIT	18.5396	18.8055	19.1978	19.6790	19.9870	20.1247	20.1518	20.1490	20.0607	19.6251	19.0035	18.5029	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5396	18.8055	19.1978	19.6790	19.9870	20.1247	20.1518	20.1490	20.0607	19.6251	19.0035	18.5029	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9814	0.9646	0.9285	0.8375	0.6892	0.4969	0.3433	0.3928	0.6502	0.8909	0.9667	0.9845	(94)
Useful gains	432.7100	509.0329	569.3782	604.3256	543.8422	392.1952	259.0904	271.3595	399.1340	453.3481	426.5184	412.0733	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1076.2460	1048.6692	955.5194	802.8477	616.0446	407.0032	261.6619	275.7193	440.6611	670.9130	888.3549	1071.7676	(97)
Space heating kWh													
	478.7908	362.6356	287.2891	142.9359	53.7186	0.0000	0.0000	0.0000	0.0000	161.8683	332.5223	490.8126	(98a)
Space heating requirement - total per year (kWh/year)												2310.5732	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	478.7908	362.6356	287.2891	142.9359	53.7186	0.0000	0.0000	0.0000	0.0000	161.8683	332.5223	490.8126	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2310.5732	
Space heating per m2											(98c) / (4) =	37.7668	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	692.4934	545.1544	558.9465	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8848	0.9311	0.9062	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	612.7002	507.5783	506.5317	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	889.7327	851.2833	778.2740	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	199.4634	255.7165	202.1763	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	49.8658	63.9291	50.5441	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												164.3390	(107)
Energy for space heating												37.7668	(99)
Energy for space cooling												2.6862	(108)
Total												40.4530	(109)
Fabric Energy Efficiency (TFEE)												40.5	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900	(1b)	x 2.4000	(2b) =	73.4160	(1b) - (3b)
First floor	30.5900	(1c)	x 2.6000	(2c) =	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		152.9500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.0000 (17)
Infiltration rate			0.2000 (18)
Number of sides sheltered			2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500 (20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11800.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 192.8880 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153
E12 Gable (insulation at ceiling level)	6.5400	0.0970	0.6344
P1 Party wall - Ground floor	6.5400	0.3200	2.0928
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3 Sill	8.3000	0.0450	0.3735
E4 Jamb	31.5000	0.0510	1.6065
E5 Ground floor (normal)	15.9000	0.0670	1.0653
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.4785 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 43.7669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	(38)
Heat transfer coeff	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	(39)

Average = Sum(39)m / 12 = 69.0036

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	(40)
HLP (average)												1.1279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.0148 (42)
Hot water usage for mixer showers

58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)

Hot water usage for baths

25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)

Hot water usage for other uses

35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)

Average daily hot water use (litres/day) 108.7725 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)
Energy content (annual)										Total = Sum(45)m =		1806.6883	
Distribution loss (46)m = 0.15 x (45)m	28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(64)

Total per year (kWh/year) = Sum(64)m = 2342.7273 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	98.7338	87.7270	94.0294	84.4273	83.0839	76.1981	76.0687	78.2739	78.2510	85.6815	89.2146	97.8659 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	24.5869	21.8378	17.7597	13.4453	10.0505	8.4850	9.1684	11.9174	15.9955	20.3100	23.7048	25.2702	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	262.5564	265.2810	258.4153	243.7990	225.3487	208.0079	196.4232	193.6987	200.5644	215.1806	233.6310	250.9718	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)

Water heating gains (Table 5)

	132.7067	130.5461	126.3836	117.2602	111.6719	105.8307	102.2428	105.2068	108.6819	115.1633	123.9092	131.5401	(72)

Total internal gains

	509.2494	507.0643	491.9580	463.9039	436.4705	411.7231	397.2339	400.2224	414.6413	440.0534	470.6444	497.1815	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	96.3139	188.4104	310.2850	452.5322	554.5952	567.7269	540.4991	464.2808	360.8743	223.5648	120.0921	79.2038	(83)
Total gains	605.5633	695.4747	802.2431	916.4361	991.0657	979.4500	937.7330	864.5032	775.5156	663.6182	590.7365	576.3854	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	
alpha	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	
util living area	0.9663	0.9417	0.8840	0.7672	0.6058	0.4418	0.3218	0.3636	0.5802	0.8367	0.9445	0.9719	(86)
Living	19.7811	20.0200	20.3739	20.7166	20.9111	20.9808	20.9960	20.9933	20.9437	20.6510	20.1379	19.7127	
Non living	18.5959	18.8913	19.3183	19.7082	19.9068	19.9669	19.9767	19.9755	19.9410	19.6506	19.0433	18.5104	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3765	20.0200	20.3739	20.7166	20.9111	20.9808	20.9960	20.9933	20.9437	20.6510	20.1379	19.8927	(87)
Th 2	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	(88)
util rest of house	0.9587	0.9293	0.8610	0.7273	0.5503	0.3747	0.2480	0.2845	0.5057	0.7962	0.9304	0.9655	(89)
MIT 2	19.4271	18.8913	19.3183	19.7082	19.9068	19.9669	19.9767	19.9755	19.9410	19.6506	19.0433	18.7749	(90)
Living area fraction									fLA = Living area / (4) =			0.2228	(91)
MIT	19.6386	19.1428	19.5535	19.9328	20.1306	20.1928	20.2038	20.2023	20.1644	19.8735	19.2872	19.0239	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6386	19.1428	19.5535	19.9328	20.1306	20.1928	20.2038	20.2023	20.1644	19.8735	19.2872	19.0239	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9558	0.9169	0.8501	0.7254	0.5589	0.3891	0.2644	0.3020	0.5198	0.7915	0.9186	0.9578	(94)
Useful gains	578.7759	637.6673	681.9986	664.7806	553.8678	381.0591	247.9473	261.0964	403.0970	525.2653	542.6338	552.0836	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1058.4175	982.8020	900.7382	761.3053	581.7399	385.9235	248.6720	262.3695	418.4654	639.9055	840.9589	1022.9059	(97)
Space heating kWh	356.8533	231.9305	162.7423	69.4978	20.7368	0.0000	0.0000	0.0000	0.0000	85.2923	214.7940	350.2918	(98a)
Space heating requirement - total per year (kWh/year)												1492.1388	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	356.8533	231.9305	162.7423	69.4978	20.7368	0.0000	0.0000	0.0000	0.0000	85.2923	214.7940	350.2918	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1492.1388	
Space heating per m2											(98c) / (4) =	24.3893	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 272.6120 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	356.8533	231.9305	162.7423	69.4978	20.7368	0.0000	0.0000	0.0000	0.0000	85.2923	214.7940	350.2918	(98)
Space heating efficiency (main heating system 1)	272.6120	272.6120	272.6120	272.6120	272.6120	0.0000	0.0000	0.0000	0.0000	272.6120	272.6120	272.6120	(210)
Space heating fuel (main heating system)	130.9016	85.0771	59.6974	25.4933	7.6067	0.0000	0.0000	0.0000	0.0000	31.2871	78.7911	128.4946	(211)
Space heating efficiency (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
	232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223 (64)
Efficiency of water heater												185.2700 (216)
(217)m	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700 (217)
Fuel for water heating, kWh/month												
	125.7260	111.2021	118.0894	103.6166	100.3213	90.2581	88.9334	92.5131	93.5905	104.5381	111.3880	124.3172 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	1.9040	1.7197	1.9040	1.8425	1.9040	1.8425	1.9040	1.9040	1.8425	1.9040	1.8425	1.9040 (231)
Lighting	21.5207	17.2647	15.5450	11.3889	8.7971	7.1873	8.0250	10.4312	13.5492	17.7772	20.0793	22.1189 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	547.3489	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	185.2700	
Water heating fuel used	1264.4939	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	22.4176	(230a)
Total electricity for the above, kWh/year	22.4176	(231)
Electricity for lighting (calculated in Appendix L)	173.6847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2007.9451	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	437.8791	17.5600	85.8243	(240)
Space heating - main system 1 (low-rate cost)	109.4698	0.0940	10.2902	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	885.1457	19.6000	173.4886	(245)
Low-rate cost	379.3482	9.4000	35.6587	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	22.4176	18.5800	3.7307	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	173.6847	18.5800	32.2706	(250)
Additional standing charges			7.0000	(251)
Total energy cost			348.2631	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1808	(257)
SAP value		80.8596	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	437.8791	0.1645	72.0462	(261)
Space heating - main system 1 (low-rate cost)	109.4698	0.1381	15.1211	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	885.1457	0.1479	130.8793	(264)
Water heating - low rate cost	379.3482	0.1241	47.0759	(264)
Space and water heating			265.1225	(265)
Pumps, fans and electric keep-hot	22.4176	0.1432	3.1106	(267)
Energy for lighting	173.6847	0.1490	25.8825	(268)
Total CO2, kg/year			294.1156	(272)
CO2 emissions per m2			4.8100	(273)
EI value			96.2882	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900 (1b)	x	2.4000 (2b)	=	73.4160	(1b) - (3b)
First floor	30.5900 (1c)	x	2.6000 (2c)	=	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.9500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11800.8900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							192.8880	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153
E12 Gable (insulation at ceiling level)	6.5400	0.0970	0.6344
P1 Party wall - Ground floor	6.5400	0.3200	2.0928
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3 Sill	8.3000	0.0450	0.3735
E4 Jamb	31.5000	0.0510	1.6065
E5 Ground floor (normal)	15.9000	0.0670	1.0653
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.4785	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	43.7669	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	(38)
Heat transfer coeff	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	(39)
Average = Sum(39)m / 12 =												69.0036	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	(40)
HLP (average)												1.1279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0148	(42)
Hot water usage for mixer showers													
	58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)
Hot water usage for baths													
	25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)
Hot water usage for other uses													
	35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)
Average daily hot water use (litres/day)												108.7725	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)
Energy content (annual)										Total = Sum(45)m =		1806.6883	
Distribution loss (46)m = 0.15 x (45)m													
	28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(64)
										Total per year (kWh/year) = Sum(64)m =		2342.7273	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	98.7338	87.7270	94.0294	84.4273	83.0839	76.1981	76.0687	78.2739	78.2510	85.6815	89.2146	97.8659	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5869	21.8378	17.7597	13.4453	10.0505	8.4850	9.1684	11.9174	15.9955	20.3100	23.7048	25.2702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.5564	265.2810	258.4153	243.7990	225.3487	208.0079	196.4232	193.6987	200.5644	215.1806	233.6310	250.9718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)													
	132.7067	130.5461	126.3836	117.2602	111.6719	105.8307	102.2428	105.2068	108.6819	115.1633	123.9092	131.5401	(72)
Total internal gains													
	509.2494	507.0643	491.9580	463.9039	436.4705	411.7231	397.2339	400.2224	414.6413	440.0534	470.6444	497.1815	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	26.6540	0.3900	0.0000	0.7700	74.3591	(76)
West	7.0400	26.6540	0.3900	0.0000	0.7700	56.3496	(80)

Solar gains	130.7087	215.6964	349.6808	520.8698	614.3607	672.0552	642.6812	554.9666	435.6935	272.7718	156.9881	107.1769	(83)
Total gains	639.9581	722.7607	841.6388	984.7736	1050.8312	1083.7783	1039.9150	955.1890	850.3348	712.8252	627.6325	604.3585	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	
alpha	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	
util living area													
	0.9511	0.9243	0.8477	0.6944	0.5076	0.3289	0.2187	0.2379	0.4524	0.7472	0.9102	0.9575	(86)
Living	19.9800	20.1668	20.5165	20.8235	20.9601	20.9948	20.9993	20.9991	20.9814	20.8101	20.3741	19.9451	
Non living	18.8442	19.0714	19.4848	19.8197	19.9498	19.9758	19.9780	19.9779	19.9683	19.8183	19.3300	18.8022	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4782	20.1668	20.5165	20.8235	20.9601	20.9948	20.9993	20.9991	20.9814	20.8101	20.3741	20.0927	(87)
Th 2	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	(88)

util rest of house													
	0.9401	0.9082	0.8187	0.6478	0.4484	0.2652	0.1511	0.1645	0.3754	0.6910	0.8874	0.9474	(89)
MIT 2	19.5261	19.0714	19.4848	19.8197	19.9498	19.9758	19.9780	19.9779	19.9683	19.8183	19.3300	19.0141	(90)
Living area fraction										fLA = Living area / (4) =		0.2228	(91)
MIT	19.7382	19.3155	19.7146	20.0433	20.1749	20.2028	20.2055	20.2054	20.1940	20.0393	19.5626	19.2544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7382	19.3155	19.7146	20.0433	20.1749	20.2028	20.2055	20.2054	20.1940	20.0393	19.5626	19.2544	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9371	0.8958	0.8103	0.6509	0.4601	0.2793	0.1662	0.1809	0.3920	0.6946	0.8764	0.9387	(94)
Useful gains	599.6776	647.4380	681.9917	641.0346	483.4760	302.7167	172.8088	172.7691	333.3262	495.1519	550.0704	567.2886	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	996.2864	939.5170	849.7539	699.9238	495.0913	303.8100	172.8904	172.8833	337.7040	554.7374	763.3606	949.1032	(97)
Space heating kWh													
	295.0769	196.2771	124.8150	42.4002	8.6418	0.0000	0.0000	0.0000	0.0000	44.3316	153.5689	284.0701	(98a)
Space heating requirement - total per year (kWh/year)												1149.1817	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	295.0769	196.2771	124.8150	42.4002	8.6418	0.0000	0.0000	0.0000	0.0000	44.3316	153.5689	284.0701	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1149.1817	
Space heating per m2											(98c) / (4) =	18.7836	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												272.6120	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	295.0769	196.2771	124.8150	42.4002	8.6418	0.0000	0.0000	0.0000	0.0000	44.3316	153.5689	284.0701	(98)
Space heating efficiency (main heating system 1)													
	272.6120	272.6120	272.6120	272.6120	272.6120	0.0000	0.0000	0.0000	0.0000	272.6120	272.6120	272.6120	(210)
Space heating fuel (main heating system)													
	108.2406	71.9987	45.7849	15.5533	3.1700	0.0000	0.0000	0.0000	0.0000	16.2618	56.3324	104.2031	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	232.9326	206.0240	218.7842	191.9705	185.8653	167.2211	164.7669	171.3991	173.3951	193.6777	206.3685	230.3223	(64)
Efficiency of water heater												185.2700	(216)
(217)m	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	(217)
Fuel for water heating, kWh/month													
	125.7260	111.2021	118.0894	103.6166	100.3213	90.2581	88.9334	92.5131	93.5905	104.5381	111.3880	124.3172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	1.9040	1.7197	1.9040	1.8425	1.9040	1.8425	1.9040	1.9040	1.8425	1.9040	1.8425	1.9040	(231)
Lighting	21.5207	17.2647	15.5450	11.3889	8.7971	7.1873	8.0250	10.4312	13.5492	17.7772	20.0793	22.1189	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												421.5448	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												185.2700	
Water heating fuel used												1264.4939	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												22.4176	(230a)
Total electricity for the above, kWh/year												22.4176	(231)
Electricity for lighting (calculated in Appendix L)												173.6847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												1882.1410	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	337.2358	27.8600	105.2176	(240)
Space heating - main system 1 (low-rate cost)	84.3090	0.1450	12.2248	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	885.1457	31.2000	276.1655	(245)
Low-rate cost	379.3482	14.5000	55.0055	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	22.4176	29.5300	5.9086	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	173.6847	29.5300	51.2891	(250)
Additional standing charges			3.0000	(251)
Total energy cost			508.8110	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	337.2358	0.1656	55.8331	(261)
Space heating - main system 1 (low-rate cost)	84.3090	0.1390	11.7175	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	885.1457	0.1479	130.8793	(264)
Water heating - low rate cost	379.3482	0.1241	47.0759	(264)
Space and water heating			245.5059	(265)
Pumps, fans and electric keep-hot	22.4176	0.1432	3.1106	(267)
Energy for lighting	173.6847	0.1490	25.8825	(268)
Total CO2, kg/year			274.4989	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	337.2358	1.2935	545.2581	(275)
Space heating - main system 1 (low-rate cost)	84.3090	1.5037	126.7773	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	885.1457	1.5527	1374.3791	(278)
Water heating - low rate cost	379.3482	1.4441	547.8077	(278)
Space and water heating			2594.2222	(279)
Pumps, fans and electric keep-hot	22.4176	1.5335	33.9169	(281)
Energy for lighting	173.6847	1.5547	270.0354	(282)
Total Primary energy kWh/year			2898.1745	(286)

SAP 10 EPC IMPROVEMENTS

2B3P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.4	-£ 91	-45 kg (16.2%)
U Solar photovoltaic panels	+ 10.6	-£ 310	-264 kg (115.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£91	0.73 kg/m²	B 83	A 97
Solar photovoltaic panels	£310	4.32 kg/m²	A 94	A 100
Total Savings	£401	5.05 kg/m²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 100

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£509	£418	£91
Space heating	£126	£150	-£24
Water heating	£331	£216	£115
Lighting	£51	£51	£0
Generated (PV)	-£0	-£310	£310
Total cost of fuels	£509	£108	£401
Total cost of uses	£508	£107	£401
Delivered energy	31 kWh/m²	-8 kWh/m²	39 kWh/m²
Carbon dioxide emissions	0.3 tonnes	-0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	-1 kg/m²	5 kg/m²
Primary energy	47 kWh/m²	10 kWh/m²	38 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900 (1b)	x	2.4000 (2b)	=	73.4160	(1b) - (3b)
First floor	30.5900 (1c)	x	2.6000 (2c)	=	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	152.9500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11800.8900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							192.8880	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153
E12 Gable (insulation at ceiling level)	6.5400	0.0970	0.6344
P1 Party wall - Ground floor	6.5400	0.3200	2.0928
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3 Sill	8.3000	0.0450	0.3735
E4 Jamb	31.5000	0.0510	1.6065
E5 Ground floor (normal)	15.9000	0.0670	1.0653
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4785	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	43.7669	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	(38)
Heat transfer coeff	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	(39)
Average = Sum(39)m / 12 =												69.0036	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	(40)
HLP (average)												1.1279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.0148	(42)
Hot water usage for mixer showers													
	58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)
Hot water usage for baths													
	25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)
Hot water usage for other uses													
	35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)
Average daily hot water use (litres/day)												108.7725	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)
Energy content (annual)										Total = Sum(45)m =		1806.6883	
Distribution loss (46)m = 0.15 x (45)m													
	28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	232.9326	206.0240	217.3884	185.2169	173.0710	154.6143	151.7399	159.3026	167.9922	192.2820	206.3685	230.3223	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												597.7819	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												597.7819	
Solar input	-0.0000	-16.2476	-57.1855	-77.5429	-99.6832	-91.5469	-90.6825	-80.1437	-56.2387	-28.5108	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	232.9326	189.7764	160.2029	107.6740	73.3878	63.0674	61.0574	79.1589	111.7535	163.7711	206.3685	230.3223	(64)
									Total per year (kWh/year) = Sum(64)m =			1679.4729	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	98.7338	87.7270	92.9128	79.0244	72.8484	66.1127	65.6471	68.5967	73.9287	84.5649	89.2146	97.8659	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5869	21.8378	17.7597	13.4453	10.0505	8.4850	9.1684	11.9174	15.9955	20.3100	23.7048	25.2702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.5564	265.2810	258.4153	243.7990	225.3487	208.0079	196.4232	193.6987	200.5644	215.1806	233.6310	250.9718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)													
	132.7067	130.5461	124.8828	109.7562	97.9146	91.8233	88.2354	92.1999	102.6787	113.6625	123.9092	131.5401	(72)
Total internal gains													
	509.2494	507.0643	490.4572	456.3999	422.7131	397.7156	383.2264	387.2154	408.6381	438.5526	470.6444	497.1815	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	19.6403	0.3900	0.0000	0.7700	54.7922	(76)
West	7.0400	19.6403	0.3900	0.0000	0.7700	41.5217	(80)

Solar gains	96.3139	188.4104	310.2850	452.5322	554.5952	567.7269	540.4991	464.2808	360.8743	223.5648	120.0921	79.2038	(83)
Total gains	605.5633	695.4747	800.7423	908.9321	977.3084	965.4425	923.7256	851.4962	769.5124	662.1174	590.7365	576.3854	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	
alpha	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	
util living area													

	0.9663	0.9417	0.8846	0.7708	0.6125	0.4477	0.3265	0.3689	0.5839	0.8375	0.9445	0.9719	(86)
Living	19.7811	20.0200	20.3720	20.7113	20.9074	20.9799	20.9957	20.9930	20.9424	20.6495	20.1379	19.7127	
Non living	18.5959	18.8913	19.3161	19.7026	19.9037	19.9663	19.9766	19.9753	19.9401	19.6491	19.0433	18.5104	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3765	20.0200	20.3720	20.7113	20.9074	20.9799	20.9957	20.9930	20.9424	20.6495	20.1379	19.8927	(87)
Th 2	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	(88)
util rest of house	0.9587	0.9293	0.8617	0.7311	0.5568	0.3800	0.2517	0.2888	0.5092	0.7971	0.9304	0.9655	(89)
MIT 2	19.4271	18.8913	19.3161	19.7026	19.9037	19.9663	19.9766	19.9753	19.9401	19.6491	19.0433	18.7749	(90)
Living area fraction										fLA = Living area / (4) =		0.2228	(91)
MIT	19.6386	19.1428	19.5514	19.9274	20.1273	20.1921	20.2036	20.2021	20.1634	19.8719	19.2872	19.0239	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6386	19.1428	19.5514	19.9274	20.1273	20.1921	20.2036	20.2021	20.1634	19.8719	19.2872	19.0239	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9558	0.9169	0.8507	0.7290	0.5653	0.3944	0.2684	0.3065	0.5233	0.7924	0.9186	0.9578	(94)
Useful gains	578.7759	637.6673	681.2003	662.5947	552.4578	380.7597	247.8964	261.0085	402.6483	524.6568	542.6338	552.0836	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1058.4175	982.8020	900.5917	760.9275	581.5126	385.8768	248.6638	262.3555	418.3939	639.7971	840.9589	1022.9059	(97)
Space heating kWh	356.8533	231.9305	163.2272	70.7997	21.6168	0.0000	0.0000	0.0000	0.0000	85.6644	214.7940	350.2918	(98a)
Space heating requirement - total per year (kWh/year)												1495.1777	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	356.8533	231.9305	163.2272	70.7997	21.6168	0.0000	0.0000	0.0000	0.0000	85.6644	214.7940	350.2918	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1495.1777	
Space heating per m2											(98c) / (4) =	24.4390	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	272.6120	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	356.8533	231.9305	163.2272	70.7997	21.6168	0.0000	0.0000	0.0000	0.0000	85.6644	214.7940	350.2918	(98)
Space heating efficiency (main heating system 1)	272.6120	272.6120	272.6120	272.6120	272.6120	0.0000	0.0000	0.0000	0.0000	272.6120	272.6120	272.6120	(210)
Space heating fuel (main heating system)	130.9016	85.0771	59.8753	25.9708	7.9295	0.0000	0.0000	0.0000	0.0000	31.4236	78.7911	128.4946	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	232.9326	189.7764	160.2029	107.6740	73.3878	63.0674	61.0574	79.1589	111.7535	163.7711	206.3685	230.3223	(64)
Efficiency of water heater												185.2700	(216)
(217)m	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	(217)
Fuel for water heating, kWh/month	125.7260	102.4324	86.4700	58.1174	39.6113	34.0408	32.9559	42.7262	60.3193	88.3960	111.3880	124.3172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.6985	7.8567	8.6985	8.4179	8.6985	8.4179	8.6985	8.6985	8.4179	8.6985	8.4179	8.6985	(231)
Lighting	21.5207	17.2647	15.5450	11.3889	8.7971	7.1873	8.0250	10.4312	13.5492	17.7772	20.0793	22.1189	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6345	-51.2858	-73.8023	-81.0802	-84.3881	-77.6689	-76.6374	-73.3358	-66.6092	-57.6746	-39.3171	-30.5917	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-14.4520	-32.2941	-68.5439	-109.6918	-151.2947	-154.0448	-152.0141	-126.4382	-89.8539	-49.1713	-20.0927	-11.3222	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	548.4636	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	185.2700	
Water heating fuel used	906.5004	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	22.4176	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	102.4176	(231)
Electricity for lighting (calculated in Appendix L)	173.6847	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3.8270	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	438.7709	17.5600	85.9991	(240)
Space heating - main system 1 (low-rate cost)	109.6927	0.0940	10.3111	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	634.5503	19.6000	124.3719	(245)
Low-rate cost	271.9501	9.4000	25.5633	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	22.4176	18.5800	3.7307	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	173.6847	18.5800	32.2706	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-748.0256	18.5800	-138.9831	
PV Unit electricity exported	-979.2138	5.5900	-54.7381	
Total			-193.7212	(252)
Total energy cost			110.3895	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3743	(257)
SAP value		93.9330	
SAP rating (Section 12)		94	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	438.7709	0.1645	72.1777	(261)
Space heating - main system 1 (low-rate cost)	109.6927	0.1381	15.1487	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	634.5503	0.1535	97.4296	(264)
Water heating - low rate cost	271.9501	0.1289	35.0474	(264)
Space and water heating			219.8033	(265)
Pumps, fans and electric keep-hot	102.4176	0.1432	14.5668	(267)
Energy for lighting	173.6847	0.1490	25.8825	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-748.0256	0.1394	-104.2407	
PV Unit electricity exported	-979.2138	0.1242	-121.6320	
Total			-225.8728	(269)
Total CO2, kg/year			34.3799	(272)
CO2 emissions per m2			0.5600	(273)
EI value			99.5661	
EI rating			100	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	30.5900	(1b) x	2.4000	(2b) =	73.4160	(1b) - (3b)
First floor	30.5900	(1c) x	2.6000	(2c) =	79.5340	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	61.1800					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		152.9500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			16.3300	0.6998	11.4285			(27)
Heatloss Floor 1			39.5000	0.1100	4.3450	75.0000	2962.5000	(28a)
External Wall 1	79.5000	18.2900	61.2100	0.1800	11.0178	60.0000	3672.6000	(29a)
External Roof 1	30.5900		30.5900	0.0900	2.7531	9.0000	275.3100	(30)
Total net area of external elements Aum(A, m2)			149.5900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	32.2884			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			107.1300			9.0000	964.1700	(32c)
Internal Floor 1			39.5000			18.0000	711.0000	(32d)
Internal Ceiling 1			30.5900			9.0000	275.3100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	11800.8900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		192.8880 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3400	0.0980	0.9153
E12 Gable (insulation at ceiling level)	6.5400	0.0970	0.6344
P1 Party wall - Ground floor	6.5400	0.3200	2.0928
P2 Party wall - Intermediate floor within a dwelling	6.5400	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	6.5400	0.4800	3.1392
E1 Steel lintel with perforated steel base plate	9.2300	0.0500	0.4615
E3 Sill	8.3000	0.0450	0.3735
E4 Jamb	31.5000	0.0510	1.6065
E5 Ground floor (normal)	15.9000	0.0670	1.0653
E6 Intermediate floor within a dwelling	15.9000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.4785 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	43.7669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	25.2368	(38)
Heat transfer coeff													
	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	69.0036	(39)
Average = Sum(39)m / 12 =												69.0036	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	1.1279	(40)
HLP (average)												1.1279	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.0148	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	58.0010	57.1294	55.8592	53.4290	51.6356	49.6356	48.4988	49.7593	51.1411	53.2885	55.7709	57.7788	(42a)
Hot water usage for baths													
	25.0656	24.6933	24.1691	23.2025	22.4788	21.6763	21.2428	21.7633	22.3301	23.1888	24.1753	24.9808	(42b)
Hot water usage for other uses													
	35.2635	33.9812	32.6989	31.4166	30.1343	28.8520	28.8520	30.1343	31.4166	32.6989	33.9812	35.2635	(42c)
Average daily hot water use (litres/day)												108.7725	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	118.3301	115.8039	112.7272	108.0481	104.2486	100.1638	98.5935	101.6569	104.8878	109.1762	113.9274	118.0232	(44)
Energy conte	187.4060	164.9032	173.2576	147.9125	140.3387	123.1631	119.2403	125.8725	129.3371	148.1511	162.3105	184.7957	(45)
Energy content (annual)										Total = Sum(45)m =		1806.6883	
Distribution loss (46)m = 0.15 x (45)m													
	28.1109	24.7355	25.9886	22.1869	21.0508	18.4745	17.8860	18.8809	19.4006	22.2227	24.3466	27.7194	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	232.9326	206.0240	217.3884	185.2169	173.0710	154.6143	151.7399	159.3026	167.9922	192.2820	206.3685	230.3223	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												748.0128	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												748.0128	
Solar input	-6.6100	-23.8582	-68.2563	-92.4471	-111.8459	-109.3619	-108.5721	-98.6271	-73.5749	-43.9997	-10.8597	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	226.3226	182.1658	149.1322	92.7698	61.2251	45.2525	43.1679	60.6755	94.4173	148.2823	195.5088	230.3223	(64)
											Total per year (kWh/year) = Sum(64)m =	1529.2421	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	98.7338	87.7270	92.9128	79.0244	72.8484	66.1127	65.6471	68.5967	73.9287	84.5649	89.2146	97.8659	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	120.8876	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5869	21.8378	17.7597	13.4453	10.0505	8.4850	9.1684	11.9174	15.9955	20.3100	23.7048	25.2702	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	262.5564	265.2810	258.4153	243.7990	225.3487	208.0079	196.4232	193.6987	200.5644	215.1806	233.6310	250.9718	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	49.1036	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	-80.5917	(71)
Water heating gains (Table 5)													
	132.7067	130.5461	124.8828	109.7562	97.9146	91.8233	88.2354	92.1999	102.6787	113.6625	123.9092	131.5401	(72)
Total internal gains													
	509.2494	507.0643	490.4572	456.3999	422.7131	397.7156	383.2264	387.2154	408.6381	438.5526	470.6444	497.1815	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2900	26.6540	0.3900	0.0000	0.7700	74.3591	(76)
West	7.0400	26.6540	0.3900	0.0000	0.7700	56.3496	(80)

Solar gains	130.7087	215.6964	349.6808	520.8698	614.3607	672.0552	642.6812	554.9666	435.6935	272.7718	156.9881	107.1769	(83)
Total gains	639.9581	722.7607	840.1380	977.2696	1037.0738	1069.7708	1025.9076	942.1821	844.3316	711.3244	627.6325	604.3585	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	47.5051	
alpha	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	4.1670	
util living area													
	0.9511	0.9243	0.8483	0.6980	0.5136	0.3331	0.2216	0.2412	0.4553	0.7482	0.9102	0.9575	(86)
Living	19.9800	20.1668	20.5149	20.8199	20.9583	20.9946	20.9993	20.9990	20.9809	20.8091	20.3741	19.9451	
Non living	18.8442	19.0714	19.4830	19.8162	19.9485	19.9757	19.9780	19.9779	19.9681	19.8174	19.3300	18.8022	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4782	20.1668	20.5149	20.8199	20.9583	20.9946	20.9993	20.9990	20.9809	20.8091	20.3741	20.0927	(87)
Th 2	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	19.9781	(88)
util rest of house													
	0.9401	0.9082	0.8194	0.6515	0.4539	0.2687	0.1532	0.1668	0.3780	0.6920	0.8874	0.9474	(89)
MIT 2	19.5261	19.0714	19.4830	19.8162	19.9485	19.9757	19.9780	19.9779	19.9681	19.8174	19.3300	19.0141	(90)
Living area fraction											fLA = Living area / (4) =	0.2228	(91)
MIT	19.7382	19.3155	19.7129	20.0399	20.1735	20.2027	20.2055	20.2054	20.1937	20.0384	19.5626	19.2544	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7382	19.3155	19.7129	20.0399	20.1735	20.2027	20.2055	20.2054	20.1937	20.0384	19.5626	19.2544	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9371	0.8958	0.8110	0.6545	0.4656	0.2829	0.1684	0.1834	0.3946	0.6956	0.8764	0.9387	(94)
Useful gains	599.6776	647.4380	681.3263	639.6125	482.8612	302.6515	172.8033	172.7614	333.1954	494.7861	550.0704	567.2886	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	996.2864	939.5170	849.6340	699.6865	494.9947	303.7998	172.8894	172.8819	337.6834	554.6753	763.3606	949.1032	(97)
Space heating kWh													
	295.0769	196.2771	125.2209	43.2533	9.0273	0.0000	0.0000	0.0000	0.0000	44.5576	153.5689	284.0701	(98a)
Space heating requirement - total per year (kWh/year)												1151.0522	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

295.0769	196.2771	125.2209	43.2533	9.0273	0.0000	0.0000	0.0000	0.0000	44.5576	153.5689	284.0701	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1151.0522

Space heating per m2 (98c) / (4) = 18.8142 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 272.6120 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	295.0769	196.2771	125.2209	43.2533	9.0273	0.0000	0.0000	0.0000	0.0000	44.5576	153.5689	284.0701	(98)
Space heating efficiency (main heating system 1)													
	272.6120	272.6120	272.6120	272.6120	272.6120	0.0000	0.0000	0.0000	0.0000	272.6120	272.6120	272.6120	(210)
Space heating fuel (main heating system)													
	108.2406	71.9987	45.9338	15.8662	3.3114	0.0000	0.0000	0.0000	0.0000	16.3447	56.3324	104.2031	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	226.3226	182.1658	149.1322	92.7698	61.2251	45.2525	43.1679	60.6755	94.4173	148.2823	195.5088	230.3223	(64)
Efficiency of water heater												185.2700	(216)
(217)m	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	185.2700	(217)
Fuel for water heating, kWh/month													
	122.1583	98.3245	80.4945	50.0728	33.0464	24.4252	23.3000	32.7498	50.9620	80.0358	105.5265	124.3172	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	8.6985	7.8567	8.6985	8.4179	8.6985	8.4179	8.6985	8.6985	8.4179	8.6985	8.4179	8.6985	(231)
Lighting	21.5207	17.2647	15.5450	11.3889	8.7971	7.1873	8.0250	10.4312	13.5492	17.7772	20.0793	22.1189	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.5153	-55.4064	-77.8153	-85.0606	-86.5317	-81.5276	-80.5327	-77.9208	-72.2906	-63.7381	-46.9434	-38.3095	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-22.1545	-38.6153	-80.4449	-132.6645	-173.2768	-191.8167	-190.2424	-159.2457	-114.4464	-64.5283	-29.2629	-17.3006	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 422.2309 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 185.2700

Water heating fuel used 825.4129 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)

mechanical ventilation fans (SFP = 0.1201) 22.4176 (230a)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 102.4176 (231)

Electricity for lighting (calculated in Appendix L) 173.6847 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -2024.5910 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses -500.8448 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	337.7847	27.8600	105.3888	(240)
Space heating - main system 1 (low-rate cost)	84.4462	0.1450	12.2447	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	577.7890	31.2000	180.2702	(245)
Low-rate cost	247.6239	14.5000	35.9055	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	22.4176	29.5300	5.9086	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	173.6847	29.5300	51.2891	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-810.5921	29.5300	-239.3678	
PV Unit electricity exported	-1213.9989	5.8100	-70.5333	
Total			-309.9012	(252)
Total energy cost			107.7297	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	337.7847	0.1655	55.9150	(261)
Space heating - main system 1 (low-rate cost)	84.4462	0.1390	11.7347	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	577.7890	0.1551	89.5873	(264)
Water heating - low rate cost	247.6239	0.1301	32.2278	(264)
Space and water heating			189.4648	(265)
Pumps, fans and electric keep-hot	102.4176	0.1432	14.5668	(267)
Energy for lighting	173.6847	0.1490	25.8825	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-810.5921	0.1399	-113.4384	
PV Unit electricity exported	-1213.9989	0.1243	-150.8998	
Total			-264.3382	(269)
Total CO2, kg/year			-34.4241	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	337.7847	1.2934	546.1132	(275)
Space heating - main system 1 (low-rate cost)	84.4462	1.5036	126.9762	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	577.7890	1.5788	912.1985	(278)
Water heating - low rate cost	247.6239	1.4684	363.5990	(278)
Space and water heating			1948.8869	(279)
Pumps, fans and electric keep-hot	102.4176	1.5335	156.5957	(281)
Energy for lighting	173.6847	1.5547	270.0354	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-810.5921	1.5216	-1233.3949	
PV Unit electricity exported	-1213.9989	0.4561	-553.6990	
Total			-1787.0939	(283)
Total Primary energy kWh/year			588.4240	(286)

Full SAP Calculation Printout

Property Reference	HT 9 Havant	**Issued on Date**	22/06/2025
Assessment Reference	2B4P ASHP	**Prop Type Ref**	3B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.69	**TER**	12.56
Environmental	96 A	**% DER < TER**			62.66
CO_2 Emissions (t/year)	0.31	**DFEE**	36.86	**TFEE**	39.86
Compliance Check	See BREL	**% DFEE < TFEE**			7.53
% DPER < TPER	25.04	**DPER**	49.23	**TPER**	65.67

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600 (1b)	x	2.4000 (2b)	=	86.3040	(1b) - (3b)
First floor	35.9600 (1c)	x	2.6000 (2c)	=	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	179.8000	(5)

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2. Ventilation rate

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			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.0000 (17)
Infiltration rate			0.2000 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11455.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.2743	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5691 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6111 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	(38)
Heat transfer coeff	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	(39)

Average = Sum(39)m / 12 = 80.2781

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	(40)
HLP (average)												1.1162	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2918 (42)

Hot water usage for mixer showers												
	62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059 (42a)
Hot water usage for baths												
	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715 (42b)
Hot water usage for other uses												
	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005 (42c)

Average daily hot water use (litres/day) 117.4860 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)

Energy content (annual) Total = Sum(45)m = 1951.4184

Distribution loss (46)m = 0.15 x (45)m												
	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7182 (55)
Total storage loss												
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642 (56)
If cylinder contains dedicated solar storage												
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month												
	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264 (64)

Total per year (kWh/year) = Sum(64)m = 2487.4574 (64)

12Total per year (kWh/year) 2487 (64)

Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month												
	103.7256	92.1193	98.6442	88.3670	86.8218	79.4785	79.2447	81.6266	81.6961	89.6278	93.5380	102.7882 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	101.7527	112.6548	101.7527	105.1444	101.7527	105.1444	101.7527	101.7527	105.1444	101.7527	105.1444	101.7527	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	201.7361	203.8295	198.5542	187.3238	173.1474	159.8235	150.9224	148.8290	154.1043	165.3347	179.5111	192.8349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)												
	139.4162	137.0823	132.5862	122.7319	116.6960	110.3868	106.5117	109.7132	113.4668	120.4674	129.9139	138.1562	(72)
Total internal gains												
	500.2822	510.9438	490.2704	472.5775	448.9733	432.7321	416.5641	417.6722	430.0928	444.9322	471.9468	490.1211	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	19.6403	0.3900	0.0000	0.7700	79.6226	(76)

West			9.8200	19.6403	0.3900	0.0000	0.7700					57.9181	(80)
Solar gains	137.5407	269.0588	443.1015	646.2371	791.9878	810.7404	771.8579	663.0146	515.3453	319.2609	171.4971	113.1068	(83)
Total gains	637.8229	780.0026	933.3719	1118.8145	1240.9611	1243.4726	1188.4220	1080.6868	945.4382	764.1930	643.4439	603.2279	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	
alpha	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	
util living area	0.9638	0.9303	0.8618	0.7261	0.5600	0.4033	0.2947	0.3372	0.5481	0.8179	0.9382	0.9698	(86)
Living	19.4696	19.8049	20.2417	20.6647	20.8912	20.9742	20.9937	20.9897	20.9247	20.5575	19.9202	19.3899	
Non living	18.2314	18.6473	19.1761	19.6604	19.8964	19.9712	19.9850	19.9830	19.9343	19.5595	18.7983	18.1317	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2171	19.8049	20.2417	20.6647	20.8912	20.9742	20.9937	20.9897	20.9247	20.5575	19.9202	19.6151	(87)
Th 2	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	(88)
util rest of house	0.9567	0.9177	0.8387	0.6875	0.5089	0.3429	0.2280	0.2649	0.4791	0.7791	0.9247	0.9638	(89)
MIT 2	19.2875	18.6473	19.1761	19.6604	19.8964	19.9712	19.9850	19.9830	19.9343	19.5595	18.7983	18.4661	(90)
Living area fraction									fLA = Living area / (4) =			0.2632	(91)
MIT	19.5322	18.9520	19.4566	19.9248	20.1582	20.2352	20.2505	20.2479	20.1950	19.8222	19.0935	18.7685	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5322	18.9520	19.4566	19.9248	20.1582	20.2352	20.2505	20.2479	20.1950	19.8222	19.0935	18.7685	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9530	0.9018	0.8249	0.6849	0.5178	0.3579	0.2455	0.2837	0.4937	0.7720	0.9097	0.9545	(94)
Useful gains	607.8578	703.4202	769.9543	766.3041	642.6017	445.0779	291.7044	306.5946	466.8051	589.9465	585.3237	575.7634	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1222.8099	1128.0672	1040.1306	885.0489	679.0091	452.3822	293.0532	308.9061	489.2943	740.3406	962.8194	1169.5348	(97)
Space heating kWh	457.5243	285.3628	201.0112	85.4962	27.0870	0.0000	0.0000	0.0000	0.0000	111.8932	271.7969	441.7659	(98a)
Space heating requirement - total per year (kWh/year)												1881.9376	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	457.5243	285.3628	201.0112	85.4962	27.0870	0.0000	0.0000	0.0000	0.0000	111.8932	271.7969	441.7659	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1881.9376	
Space heating per m2										(98c) / (4) =		26.1671	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.9537	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	457.5243	285.3628	201.0112	85.4962	27.0870	0.0000	0.0000	0.0000	0.0000	111.8932	271.7969	441.7659	(98)
Space heating efficiency (main heating system 1)	266.9537	266.9537	266.9537	266.9537	266.9537	0.0000	0.0000	0.0000	0.0000	266.9537	266.9537	266.9537	(210)
Space heating fuel (main heating system)	171.3872	106.8960	75.2982	32.0266	10.1467	0.0000	0.0000	0.0000	0.0000	41.9148	101.8143	165.4841	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(64)
Efficiency of water heater												184.1544	(216)
(217)m	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	(217)
Fuel for water heating, kWh/month	134.6401	119.0490	126.3413	110.6784	107.0336	96.1622	94.6590	98.5491	99.7838	111.6162	119.1235	133.1092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.2382	2.0216	2.2382	2.1660	2.2382	2.1660	2.2382	2.2382	2.1660	2.2382	2.1660	2.2382	(231)
Lighting	25.9546	20.8218	18.7477	13.7354	10.6096	8.6681	9.6784	12.5804	16.3407	21.4398	24.2162	26.6760	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												704.9679	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.1544	
Water heating fuel used	1350.7455	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	26.3530	(230a)
Total electricity for the above, kWh/year	26.3530	(231)
Electricity for lighting (calculated in Appendix L)	209.4686	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2291.5350	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	563.9743	0.1645	92.7770	(261)
Space heating - main system 1 (low-rate cost)	140.9936	0.1381	19.4718	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	945.5218	0.1479	139.8445	(264)
Water heating - low rate cost	405.2236	0.1241	50.3007	(264)
Space and water heating			302.3940	(265)
Pumps, fans and electric keep-hot	26.3530	0.1432	3.6567	(267)
Energy for lighting	209.4686	0.1490	31.2150	(268)
Total CO2, kg/year			337.2656	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.6900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	563.9743	1.2905	909.7277	(275)
Space heating - main system 1 (low-rate cost)	140.9936	1.5002	211.5217	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	945.5218	1.5529	1468.2636	(278)
Water heating - low rate cost	405.2236	1.4442	585.2287	(278)
Space and water heating			3174.7416	(279)
Pumps, fans and electric keep-hot	26.3530	1.5335	39.8709	(281)
Energy for lighting	209.4686	1.5547	325.6701	(282)
Total Primary energy kWh/year			3540.2826	(286)
Dwelling Primary energy Rate (DPER)			49.2300	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b) x	2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c) x	2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3543	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4518	0.4429	0.4340	0.3898	0.3809	0.3366	0.3366	0.3277	0.3543	0.3809	0.3986	0.4163 (22b)
Effective ac	0.6020	0.5981	0.5942	0.5760	0.5725	0.5567	0.5567	0.5537	0.5628	0.5725	0.5794	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			16.0300	1.1450	18.3550			(27)
Heatloss Floor 1			35.9600	0.1300	4.6748			(28a)
External Wall 1	85.2000	17.9900	67.2100	0.1800	12.0978			(29a)
External Roof 1	35.9600		35.9600	0.1100	3.9556			(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0432			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 159.2743 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0600	0.5616
E12 Gable (insulation at ceiling level)	7.6900	0.0600	0.4614
P1 Party wall - Ground floor	7.6900	0.0800	0.6152
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.1200	0.9228
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0500	0.6125
E4 Jamb	42.0000	0.0500	2.1000
E5 Ground floor (normal)	17.0400	0.1600	2.7264
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1589 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 51.2021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.7217	35.4866	35.2562	34.1737	33.9712	33.0284	33.0284	32.8538	33.3916	33.9712	34.3809	34.8092	(38)
Heat transfer coeff	86.9238	86.6887	86.4582	85.3758	85.1733	84.2305	84.2305	84.0559	84.5936	85.1733	85.5830	86.0113	(39)
Average = Sum(39)m / 12 =												85.3748	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2086	1.2053	1.2021	1.1871	1.1843	1.1712	1.1712	1.1687	1.1762	1.1843	1.1900	1.1959	(40)
HLP (average)												1.1871	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2918 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059	(42a)
Hot water usage for baths	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)
Hot water usage for other uses	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)
Average daily hot water use (litres/day)												117.4860	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)
Energy content (annual)										Total = Sum(45)m =		1951.4184	
Distribution loss (46)m = 0.15 x (45)m	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	254.1656	224.8521	238.8831	209.8385	203.3271	183.1063	180.5388	187.7025	189.7757	211.7661	225.3905	251.3464	(62)
WWHRS	-28.6391	-25.3287	-26.5227	-21.9619	-20.4677	-17.5143	-16.4169	-17.4577	-18.1210	-21.3627	-24.2013	-28.1088	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	225.5265	199.5234	212.3604	187.8767	182.8595	165.5920	164.1219	170.2448	171.6547	190.4035	201.1892	223.2376	(64)
									Total per year (kWh/year) = Sum(64)m =			2294.5901	(64)
12Total per year (kWh/year)												2295	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	108.7016	96.6137	103.6202	93.1825	91.7978	84.2940	84.2207	86.6026	86.5116	94.6038	98.3535	107.7642	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
101.7533 112.6554 101.7533 105.1451 101.7533 105.1451 101.7533 101.7533 105.1451 101.7533 105.1451 101.7533 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
201.7361 203.8295 198.5542 187.3238 173.1474 159.8235 150.9224 148.8290 154.1043 165.3347 179.5111 192.8349 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 34.4591 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 -91.6728 (71)
Water heating gains (Table 5)
146.1043 143.7704 139.2744 129.4201 123.3842 117.0750 113.1998 116.4014 120.1550 127.1556 136.6021 144.8443 (72)
Total internal gains
509.9710 520.6327 499.9592 482.2663 458.6621 439.4209 423.2529 424.3610 436.7816 454.6209 481.6356 499.8099 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2800	19.6403	0.6300	0.7000	0.7700	55.7015	(76)
West	6.7500	19.6403	0.6300	0.7000	0.7700	40.5157	(80)

Solar gains 96.2172 188.2212 309.9736 452.0780 554.0385 567.1570 539.9566 463.8147 360.5121 223.3403 119.9715 79.1243 (83)
Total gains 606.1882 708.8539 809.9328 934.3442 1012.7006 1006.5779 963.2094 888.1757 797.2937 677.9613 601.6071 578.9342 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.6062	36.7054	36.8033	37.2699	37.3585	37.7767	37.7767	37.8551	37.6145	37.3585	37.1797	36.9945	
alpha	3.4404	3.4470	3.4536	3.4847	3.4906	3.5184	3.5184	3.5237	3.5076	3.4906	3.4786	3.4663	
util living area	0.9705	0.9499	0.9087	0.8143	0.6740	0.5062	0.3764	0.4219	0.6451	0.8680	0.9516	0.9744	(86)
MIT	19.2222	19.5113	19.9322	20.4364	20.7730	20.9385	20.9833	20.9752	20.8559	20.3840	19.7232	19.1802	(87)
Th 2	19.9131	19.9157	19.9183	19.9303	19.9326	19.9431	19.9431	19.9451	19.9391	19.9326	19.9280	19.9233	(88)
util rest of house	0.9644	0.9399	0.8907	0.7801	0.6193	0.4322	0.2896	0.3307	0.5698	0.8347	0.9402	0.9691	(89)
MIT 2	17.8717	18.2352	18.7570	19.3648	19.7359	19.9030	19.9361	19.9337	19.8335	19.3237	18.5150	17.8255	(90)
Living area fraction									fLA = Living area / (4) =			0.2632	(91)
MIT	18.2272	18.5711	19.0663	19.6468	20.0089	20.1755	20.2117	20.2079	20.1026	19.6028	18.8330	18.1820	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2272	18.5711	19.0663	19.6468	20.0089	20.1755	20.2117	20.2079	20.1026	19.6028	18.8330	18.1820	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9515	0.9239	0.8735	0.7699	0.6235	0.4490	0.3121	0.3540	0.5822	0.8225	0.9250	0.9572	(94)
Useful gains	576.8066	654.9244	707.4883	719.3563	631.4256	451.9297	300.5900	314.4024	464.1976	557.6430	556.4692	554.1694	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1210.6037	1185.1300	1086.4629	917.5182	707.6945	469.6309	304.2176	320.0728	507.7833	766.7951	1004.1428	1202.6140	(97)
Space heating kWh	471.5450	356.2981	281.9571	142.6766	56.7441	0.0000	0.0000	0.0000	0.0000	155.6092	322.3250	482.4428	(98a)
Space heating requirement - total per year (kWh/year)												2269.5978	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	471.5450	356.2981	281.9571	142.6766	56.7441	0.0000	0.0000	0.0000	0.0000	155.6092	322.3250	482.4428	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2269.5978	
Space heating per m2											(98c) / (4) =	31.5573	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	471.5450	356.2981	281.9571	142.6766	56.7441	0.0000	0.0000	0.0000	0.0000	155.6092	322.3250	482.4428	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	510.8830	386.0218	305.4790	154.5792	61.4779	0.0000	0.0000	0.0000	0.0000	168.5907	349.2145	522.6899	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	225.5265	199.5234	212.3604	187.8767	182.8595	165.5920	164.1219	170.2448	171.6547	190.4035	201.1892	223.2376	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6739	85.3448	84.6963	83.4507	81.7625	79.8000	79.8000	79.8000	79.8000	83.6110	85.1111	85.7409	(217)
Fuel for water heating, kWh/month	263.2384	233.7851	250.7315	225.1351	223.6471	207.5088	205.6665	213.3393	215.1061	227.7254	236.3843	260.3629	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	21.1423	16.9612	15.2716	11.1887	8.6424	7.0610	7.8839	10.2478	13.3109	17.4646	19.7263	21.7299	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-33.7131	-47.5682	-68.4425	-77.0484	-83.1790	-77.6873	-76.7309	-72.3861	-64.7378	-54.4322	-37.0783	-29.1427	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.9394	-39.8522	-79.2233	-119.0066	-157.3699	-158.1144	-156.2500	-132.2903	-96.9594	-56.9962	-25.2892	-14.9759	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2458.9359	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2762.6306	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	170.6307	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1777.4131	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3700.7841	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2458.9359	0.2100	516.3765	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2762.6306	0.2100	580.1524	(264)
Space and water heating			1096.5290	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	170.6307	0.1443	24.6273	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-722.1463	0.1346	-97.1721	
PV Unit electricity exported	-1055.2668	0.1259	-132.8501	
Total			-230.0222	(269)
Total CO2, kg/year			903.0633	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.5600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2458.9359	1.1300	2778.5976	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2762.6306	1.1300	3121.7726	(278)
Space and water heating			5900.3701	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	170.6307	1.5338	261.7190	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-722.1463	1.4973	-1081.2768	
PV Unit electricity exported	-1055.2668	0.4621	-487.6513	
Total			-1568.9280	(283)
Total Primary energy kWh/year			4723.2619	(286)
Target Primary Energy Rate (TPER)			65.6700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b) x	2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c) x	2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3669	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3118	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3976	0.3898	0.3820	0.3430	0.3352	0.2962	0.2962	0.2884	0.3118	0.3352	0.3508	0.3664	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)
Effective ac 0.5790 0.5760 0.5730 0.5588 0.5562 0.5439 0.5439 0.5416 0.5486 0.5562 0.5615 0.5671		(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11455.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.2743	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5691	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 50.6111	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	34.3564	34.1743	33.9958	33.1574	33.0006	32.2704	32.2704	32.1352	32.5517	33.0006	33.3179	33.6496	(38)
Heat transfer coeff	84.9675	84.7854	84.6069	83.7685	83.6117	82.8815	82.8815	82.7463	83.1628	83.6117	83.9290	84.2607	(39)
Average = Sum(39)m / 12 =												83.7678	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1814	1.1789	1.1764	1.1647	1.1626	1.1524	1.1524	1.1505	1.1563	1.1626	1.1670	1.1716	(40)
HLP (average)												1.1647	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2918	(42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)
Hot water usage for other uses	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)
Average daily hot water use (litres/day)												59.7286	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.1636	63.3762	61.4247	58.9956	56.8287	54.5768	54.1088	56.0563	58.0537	60.3663	62.8169	65.0721	(44)
Energy conte	103.2032	90.2468	94.4075	80.7621	76.5024	67.1085	65.4399	69.4094	71.5860	81.9165	89.4942	101.8872	(45)
Energy content (annual)										Total = Sum(45)m =		991.9636	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	87.7227	76.7098	80.2464	68.6478	65.0270	57.0422	55.6239	58.9980	60.8481	69.6291	76.0700	86.6041	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	87.7227	76.7098	80.2464	68.6478	65.0270	57.0422	55.6239	58.9980	60.8481	69.6291	76.0700	86.6041	(64)
										Total per year (kWh/year) = Sum(64)m =		843.1691	(64)
12Total per year (kWh/year)												843	(64)
Electric shower(s)													
	50.1690	44.7010	48.8117	46.5804	47.4545	45.2670	46.7759	47.4545	46.5804	48.8117	47.8939	50.1690	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							570.6691	(64a)
Heat gains from water heating, kWh/month													
	34.4729	30.3527	32.2645	28.8071	28.1204	25.5773	25.5999	26.6131	26.8571	29.6102	30.9910	34.1933	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	101.7527	112.6548	101.7527	105.1444	101.7527	105.1444	101.7527	101.7527	105.1444	101.7527	105.1444	101.7527	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	201.7361	203.8295	198.5542	187.3238	173.1474	159.8235	150.9224	148.8290	154.1043	165.3347	179.5111	192.8349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)													
	46.3346	45.1677	43.3663	40.0098	37.7962	35.5240	34.4085	35.7703	37.3016	39.7987	43.0430	45.9587	(72)
Total internal gains													
	407.2006	419.0292	401.0505	389.8553	370.0736	357.8693	344.4609	343.7293	353.9276	364.2634	385.0759	397.9236	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	19.6403	0.3900	0.0000	0.7700	79.6226	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	137.5407	269.0588	443.1015	646.2371	791.9878	810.7404	771.8579	663.0146	515.3453	319.2609	171.4971	113.1068	(83)
Total gains	544.7413	688.0880	844.1520	1036.0924	1162.0614	1168.6098	1116.3189	1006.7439	869.2730	683.5243	556.5730	511.0304	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.4490	37.5294	37.6086	37.9850	38.0562	38.3915	38.3915	38.4543	38.2617	38.0562	37.9124	37.7631	
alpha	3.4966	3.5020	3.5072	3.5323	3.5371	3.5594	3.5594	3.5636	3.5508	3.5371	3.5275	3.5175	
util living area													
	0.9780	0.9528	0.8968	0.7707	0.6054	0.4386	0.3226	0.3707	0.5996	0.8626	0.9602	0.9821	(86)
MIT	19.1625	19.5280	20.0247	20.5522	20.8456	20.9626	20.9904	20.9844	20.8903	20.4167	19.6843	19.1007	(87)
Th 2	19.9349	19.9369	19.9389	19.9483	19.9501	19.9583	19.9583	19.9598	19.9551	19.9501	19.9465	19.9428	(88)
util rest of house													
	0.9734	0.9434	0.8773	0.7335	0.5515	0.3724	0.2480	0.2900	0.5263	0.8287	0.9506	0.9783	(89)
MIT 2	18.2798	18.6385	19.1159	19.6035	19.8482	19.9397	19.9551	19.9543	19.8936	19.5015	18.8037	18.2246	(90)
Living area fraction										fLA = Living area / (4) =		0.2632	(91)
MIT	18.5121	18.8727	19.3551	19.8532	20.1107	20.2089	20.2276	20.2254	20.1560	19.7424	19.0355	18.4552	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5121	18.8727	19.3551	19.8532	20.1107	20.2089	20.2276	20.2254	20.1560	19.7424	19.0355	18.4552	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9651	0.9315	0.8648	0.7298	0.5601	0.3887	0.2675	0.3109	0.5411	0.8210	0.9399	0.9710	(94)
Useful gains	525.7256	640.9803	730.0458	756.1440	650.8866	454.1928	298.5975	313.0076	470.3523	561.1602	523.1201	496.1890	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1207.5693	1184.6770	1087.6299	917.5368	703.2347	464.8749	300.6631	316.5396	503.6296	764.4081	1001.7332	1201.1529	(97)
Space heating kWh													
	507.2917	365.3642	266.0426	116.2028	38.9470	0.0000	0.0000	0.0000	0.0000	151.2164	344.6014	524.4932	(98a)
Space heating requirement - total per year (kWh/year)												2314.1592	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	507.2917	365.3642	266.0426	116.2028	38.9470	0.0000	0.0000	0.0000	0.0000	151.2164	344.6014	524.4932	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2314.1592	
Space heating per m2											(98c) / (4) =	32.1769	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

	0.0000	0.0000	0.0000	0.0000	0.0000	779.0862	613.3232	628.8718	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9320	0.9596	0.9427	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	726.1336	588.5687	592.8102	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1327.4674	1268.3366	1142.2388	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	432.9604	505.7473	408.7749	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	108.2401	126.4368	102.1937	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												336.8706	(107)
Energy for space heating												32.1769	(99)
Energy for space cooling												4.6840	(108)
Total												36.8608	(109)
Fabric Energy Efficiency (DFEE)												36.9	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b) x	2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c) x	2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1669	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4169	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3543	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4518	0.4429	0.4340	0.3898	0.3809	0.3366	0.3366	0.3277	0.3543	0.3809	0.3986	0.4163	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.6020	0.5981	0.5942	0.5760	0.5725	0.5567	0.5567	0.5537	0.5628	0.5725	0.5794	0.5867	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			16.0300	1.1450	18.3550			(27)
Heatloss Floor 1			35.9600	0.1300	4.6748			(28a)
External Wall 1	85.2000	17.9900	67.2100	0.1800	12.0978			(29a)
External Roof 1	35.9600		35.9600	0.1100	3.9556			(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0432			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.2743	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0600	0.5616
E12 Gable (insulation at ceiling level)	7.6900	0.0600	0.4614
P1 Party wall - Ground floor	7.6900	0.0800	0.6152
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.1200	0.9228
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0500	0.6125
E4 Jamb	42.0000	0.0500	2.1000
E5 Ground floor (normal)	17.0400	0.1600	2.7264
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000

E18 Party wall between dwellings 10.0000 0.0600 0.6000
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1589 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 51.2021 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.7217	35.4866	35.2562	34.1737	33.9712	33.0284	33.0284	32.8538	33.3916	33.9712	34.3809	34.8092	(38)
Heat transfer coeff	86.9238	86.6887	86.4582	85.3758	85.1733	84.2305	84.2305	84.0559	84.5936	85.1733	85.5830	86.0113	(39)

Average = Sum(39)m / 12 = 85.3748

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2086	1.2053	1.2021	1.1871	1.1843	1.1712	1.1712	1.1687	1.1762	1.1843	1.1900	1.1959	(40)
HLP (average)												1.1871	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2918 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)

Hot water usage for other uses

38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)

Average daily hot water use (litres/day) 59.7286 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	65.1636	63.3762	61.4247	58.9956	56.8287	54.5768	54.1088	56.0563	58.0537	60.3663	62.8169	65.0721	(44)
Energy conte	103.2032	90.2468	94.4075	80.7621	76.5024	67.1085	65.4399	69.4094	71.5860	81.9165	89.4942	101.8872	(45)
Energy content (annual)										Total = Sum(45)m =		991.9636	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	87.7227	76.7098	80.2464	68.6478	65.0270	57.0422	55.6239	58.9980	60.8481	69.6291	76.0700	86.6041	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	87.7227	76.7098	80.2464	68.6478	65.0270	57.0422	55.6239	58.9980	60.8481	69.6291	76.0700	86.6041	(64)
									Total per year (kWh/year) = Sum(64)m =			843.1691	(64)
12Total per year (kWh/year)												843	(64)
Electric shower(s)	50.1690	44.7010	48.8117	46.5804	47.4545	45.2670	46.7759	47.4545	46.5804	48.8117	47.8939	50.1690	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			570.6691	(64a)
Heat gains from water heating, kWh/month	34.4729	30.3527	32.2645	28.8071	28.1204	25.5773	25.5999	26.6131	26.8571	29.6102	30.9910	34.1933	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	114.5910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	101.7533	112.6554	101.7533	105.1451	101.7533	105.1451	101.7533	101.7533	105.1451	101.7533	105.1451	101.7533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.7361	203.8295	198.5542	187.3238	173.1474	159.8235	150.9224	148.8290	154.1043	165.3347	179.5111	192.8349	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	34.4591	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)	46.3346	45.1677	43.3663	40.0098	37.7962	35.5240	34.4085	35.7703	37.3016	39.7987	43.0430	45.9587	(72)
Total internal gains	407.2013	419.0299	401.0511	389.8560	370.0742	357.8700	344.4615	343.7300	353.9283	364.2640	385.0766	397.9242	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.2800	19.6403	0.6300	0.7000	0.7700	55.7015	(76)
West	6.7500	19.6403	0.6300	0.7000	0.7700	40.5157	(80)

Solar gains	96.2172	188.2212	309.9736	452.0780	554.0385	567.1570	539.9566	463.8147	360.5121	223.3403	119.9715	79.1243	(83)
Total gains	503.4184	607.2512	711.0247	841.9339	924.1127	925.0270	884.4181	807.5447	714.4403	587.6043	505.0481	477.0486	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	36.6062	36.7054	36.8033	37.2699	37.3585	37.7767	37.7767	37.8551	37.6145	37.3585	37.1797	36.9945	
alpha	3.4404	3.4470	3.4536	3.4847	3.4906	3.5184	3.5184	3.5237	3.5076	3.4906	3.4786	3.4663	
util living area													

	0.9828	0.9671	0.9336	0.8490	0.7140	0.5429	0.4074	0.4595	0.6939	0.9045	0.9701	0.9855	(86)
MIT	19.0295	19.3339	19.7834	20.3410	20.7259	20.9234	20.9786	20.9675	20.8174	20.2659	19.5524	18.9861	(87)
Th 2	19.9131	19.9157	19.9183	19.9303	19.9326	19.9431	19.9431	19.9451	19.9391	19.9326	19.9280	19.9233	(88)
util rest of house													
	0.9790	0.9601	0.9195	0.8184	0.6605	0.4659	0.3145	0.3620	0.6192	0.8777	0.9626	0.9824	(89)
MIT 2	18.1332	18.4346	18.8739	19.4071	19.7444	19.9035	19.9360	19.9333	19.8321	19.3542	18.6624	18.0975	(90)
Living area fraction										fLA = Living area / (4) =		0.2632	(91)
MIT	18.3691	18.6713	19.1133	19.6529	20.0028	20.1720	20.2104	20.2055	20.0914	19.5942	18.8967	18.3314	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3691	18.6713	19.1133	19.6529	20.0028	20.1720	20.2104	20.2055	20.0914	19.5942	18.8967	18.3314	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9717	0.9497	0.9067	0.8094	0.6643	0.4833	0.3385	0.3868	0.6309	0.8674	0.9530	0.9759	(94)
Useful gains	489.1661	576.7126	644.6573	681.4318	613.8680	447.0481	299.4043	312.3707	450.7246	509.6810	481.2995	465.5432	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1222.9426	1193.8146	1090.5250	918.0377	707.1723	469.3286	304.1061	319.8767	506.8369	766.0612	1009.5937	1215.4591	(97)
Space heating kWh													
	545.9298	414.6926	331.7256	170.3563	69.4184	0.0000	0.0000	0.0000	0.0000	190.7469	380.3718	557.9374	(98a)
Space heating requirement - total per year (kWh/year)												2661.1787	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	545.9298	414.6926	331.7256	170.3563	69.4184	0.0000	0.0000	0.0000	0.0000	190.7469	380.3718	557.9374	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2661.1787	
Space heating per m2											(98c) / (4) =	37.0019	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	791.7665	623.3056	638.8248	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8717	0.9185	0.8925	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	690.1558	572.5050	570.1688	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1042.7596	997.2831	909.4079	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	253.8747	316.0349	252.3939	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	63.4687	79.0087	63.0985	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												205.5759	(107)
Energy for space heating												37.0019	(99)
Energy for space cooling												2.8584	(108)
Total												39.8603	(109)
Fabric Energy Efficiency (TFEE)												39.9	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b)	x 2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c)	x 2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

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2. Ventilation rate

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	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 11455.0100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 159.2743 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.5691 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 50.6111 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	(38)
Heat transfer coeff	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	(39)

Average = Sum(39)m / 12 = 80.2781

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	(40)
HLP (average)												1.1162	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2918 (42)
Hot water usage for mixer showers

62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059	(42a)

Hot water usage for baths

27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)

Hot water usage for other uses

38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)

Average daily hot water use (litres/day) 117.4860 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)
Energy content (annual)										Total = Sum(45)m =		1951.4184	
Distribution loss (46)m = 0.15 x (45)m	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(64)

Total per year (kWh/year) = Sum(64)m = 2487.4574 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	103.7256	92.1193	98.6442	88.3670	86.8218	79.4785	79.2447	81.6266	81.6961	89.6278	93.5380	102.7882 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	29.6524	26.3370	21.4187	16.2153	12.1212	10.2332	11.0573	14.3727	19.2911	24.4944	28.5886	30.4766 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	301.0986	304.2231	296.3495	279.5877	258.4289	238.5426	225.2573	222.1329	230.0064	246.7682	267.9271	287.8134 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728 (71)

Water heating gains (Table 5)

	139.4162	137.0823	132.5862	122.7319	116.6960	110.3868	106.5117	109.7132	113.4668	120.4674	129.9139	138.1562 (72)

Total internal gains

	567.0464	564.5216	547.2337	515.4142	484.1252	456.0418	439.7055	443.0980	459.6434	488.6093	523.3088	553.3253 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	19.6403	0.3900	0.0000	0.7700	79.6226	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	137.5407	269.0588	443.1015	646.2371	791.9878	810.7404	771.8579	663.0146	515.3453	319.2609	171.4971	113.1068	(83)
Total gains	704.5871	833.5803	990.3351	1161.6512	1276.1130	1266.7822	1211.5634	1106.1125	974.9887	807.8702	694.8058	666.4321	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	
alpha	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	
util living area	0.9520	0.9173	0.8430	0.7097	0.5475	0.3964	0.2892	0.3297	0.5344	0.7973	0.9244	0.9597	(86)
Living	19.5877	19.8872	20.3061	20.6901	20.8989	20.9756	20.9941	20.9904	20.9307	20.5978	20.0016	19.5049	
Non living	18.3781	18.7471	19.2503	19.6868	19.9032	19.9721	19.9851	19.9833	19.9388	19.6023	18.8965	18.2751	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2775	19.8872	20.3061	20.6901	20.8989	20.9756	20.9941	20.9904	20.9307	20.5978	20.0016	19.7141	(87)
Th 2	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	(88)
util rest of house	0.9430	0.9029	0.8181	0.6705	0.4969	0.3369	0.2237	0.2589	0.4663	0.7565	0.9086	0.9520	(89)
MIT 2	19.3460	18.7471	19.2503	19.6868	19.9032	19.9721	19.9851	19.9833	19.9388	19.6023	18.8965	18.5837	(90)
Living area fraction									fLA = Living area / (4) =			0.2632	(91)
MIT	19.5912	19.0472	19.5282	19.9509	20.1653	20.2362	20.2507	20.2484	20.1999	19.8643	19.1874	18.8812	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5912	19.0472	19.5282	19.9509	20.1653	20.2362	20.2507	20.2484	20.1999	19.8643	19.1874	18.8812	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9390	0.8868	0.8055	0.6690	0.5060	0.3517	0.2409	0.2774	0.4810	0.7510	0.8932	0.9414	(94)
Useful gains	661.5859	739.2566	797.6862	777.1552	645.7545	445.5687	291.8057	306.7980	468.9992	606.7326	620.6294	627.3625	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1227.5454	1135.7085	1045.8806	887.1437	679.5747	452.4672	293.0710	308.9418	489.6848	743.7201	970.3508	1178.5823	(97)
Space heating kWh	421.0739	266.4157	184.6566	79.1917	25.1622	0.0000	0.0000	0.0000	0.0000	101.9187	251.7994	410.1076	(98a)
Space heating requirement - total per year (kWh/year)												1740.3257	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	421.0739	266.4157	184.6566	79.1917	25.1622	0.0000	0.0000	0.0000	0.0000	101.9187	251.7994	410.1076	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1740.3257	
Space heating per m2											(98c) / (4) =	24.1981	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.9537	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	421.0739	266.4157	184.6566	79.1917	25.1622	0.0000	0.0000	0.0000	0.0000	101.9187	251.7994	410.1076	(98)
Space heating efficiency (main heating system 1)	266.9537	266.9537	266.9537	266.9537	266.9537	0.0000	0.0000	0.0000	0.0000	266.9537	266.9537	266.9537	(210)
Space heating fuel (main heating system)	157.7330	99.7985	69.1718	29.6649	9.4257	0.0000	0.0000	0.0000	0.0000	38.1784	94.3233	153.6250	(211)
Space heating efficiency (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264 (64)
Efficiency of water heater												184.1544 (216)
(217)m	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544 (217)
Fuel for water heating, kWh/month												
	134.6401	119.0490	126.3413	110.6784	107.0336	96.1622	94.6590	98.5491	99.7838	111.6162	119.1235	133.1092 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	2.2382	2.0216	2.2382	2.1660	2.2382	2.1660	2.2382	2.2382	2.1660	2.2382	2.1660	2.2382 (231)
Lighting	25.9546	20.8218	18.7477	13.7354	10.6096	8.6681	9.6784	12.5804	16.3407	21.4398	24.2162	26.6760 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	651.9206	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.1544	
Water heating fuel used	1350.7455	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	26.3530	(230a)
Total electricity for the above, kWh/year	26.3530	(231)
Electricity for lighting (calculated in Appendix L)	209.4686	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2238.4876	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	521.5364	17.5600	102.2211	(240)
Space heating - main system 1 (low-rate cost)	130.3841	0.0940	12.2561	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	945.5218	19.6000	185.3223	(245)
Low-rate cost	405.2236	9.4000	38.0910	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	26.3530	18.5800	4.3857	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	209.4686	18.5800	38.9193	(250)
Additional standing charges			7.0000	(251)
Total energy cost			388.1955	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1953	(257)
SAP value		80.6248	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	521.5364	0.1645	85.8065	(261)
Space heating - main system 1 (low-rate cost)	130.3841	0.1381	18.0090	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	945.5218	0.1479	139.8445	(264)
Water heating - low rate cost	405.2236	0.1241	50.3007	(264)
Space and water heating			293.9606	(265)
Pumps, fans and electric keep-hot	26.3530	0.1432	3.6567	(267)
Energy for lighting	209.4686	0.1490	31.2150	(268)
Total CO2, kg/year			328.8323	(272)
CO2 emissions per m2			4.5700	(273)
EI value			96.2313	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b) x	2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c) x	2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11455.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							159.2743	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.5691 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	50.6111 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	(38)
Heat transfer coeff	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	(39)
Average = Sum(39)m / 12 =												80.2781	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	(40)
HLP (average)												1.1162	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2918	(42)
Hot water usage for mixer showers													
	62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059	(42a)
Hot water usage for baths													
	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)
Hot water usage for other uses													
	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)
Average daily hot water use (litres/day)												117.4860	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)
Energy content (annual)										Total = Sum(45)m =		1951.4184	
Distribution loss (46)m = 0.15 x (45)m													
	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(64)
										Total per year (kWh/year) = Sum(64)m =		2487.4574	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7256	92.1193	98.6442	88.3670	86.8218	79.4785	79.2447	81.6266	81.6961	89.6278	93.5380	102.7882	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6524	26.3370	21.4187	16.2153	12.1212	10.2332	11.0573	14.3727	19.2911	24.4944	28.5886	30.4766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.0986	304.2231	296.3495	279.5877	258.4289	238.5426	225.2573	222.1329	230.0064	246.7682	267.9271	287.8134	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)													
	139.4162	137.0823	132.5862	122.7319	116.6960	110.3868	106.5117	109.7132	113.4668	120.4674	129.9139	138.1562	(72)
Total internal gains													
	567.0464	564.5216	547.2337	515.4142	484.1252	456.0418	439.7055	443.0980	459.6434	488.6093	523.3088	553.3253	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	26.6540	0.3900	0.0000	0.7700	108.0568	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	186.6581	308.0245	499.3604	743.8263	877.3356	959.7261	917.7786	792.5182	622.1906	389.5308	224.1862	153.0537	(83)
Total gains	753.7045	872.5460	1046.5941	1259.2404	1361.4608	1415.7679	1357.4841	1235.6161	1081.8340	878.1401	747.4950	706.3789	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	
alpha	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	
util living area													
	0.9320	0.8952	0.8009	0.6342	0.4551	0.2924	0.1947	0.2138	0.4121	0.7025	0.8829	0.9407	(86)
Living	19.8237	20.0573	20.4653	20.8050	20.9522	20.9927	20.9988	20.9984	20.9753	20.7773	20.2757	19.7776	
Non living	18.6720	18.9551	19.4358	19.8078	19.9517	19.9839	19.9873	19.9872	19.9733	19.7937	19.2287	18.6168	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3982	20.0573	20.4653	20.8050	20.9522	20.9927	20.9988	20.9984	20.9753	20.7773	20.2757	19.9486	(87)
Th 2	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	(88)

util rest of house													
	0.9192	0.8771	0.7706	0.5903	0.4023	0.2365	0.1352	0.1485	0.3430	0.6486	0.8585	0.9291	(89)
MIT 2	19.4631	18.9551	19.4358	19.8078	19.9517	19.9839	19.9873	19.9872	19.9733	19.7937	19.2287	18.8638	(90)
Living area fraction										fLA = Living area / (4) =		0.2632	(91)
MIT	19.7093	19.2452	19.7068	20.0703	20.2151	20.2494	20.2536	20.2534	20.2371	20.0526	19.5043	19.1493	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7093	19.2452	19.7068	20.0703	20.2151	20.2494	20.2536	20.2534	20.2371	20.0526	19.5043	19.1493	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9152	0.8615	0.7614	0.5941	0.4144	0.2510	0.1509	0.1657	0.3603	0.6523	0.8448	0.9174	(94)
Useful gains	689.7882	751.7402	796.9072	748.0669	564.1272	355.4195	204.8169	204.7326	389.7976	572.7894	631.5096	648.0625	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1156.7477	1087.3819	987.9632	816.4527	579.2111	357.1931	204.9948	204.9788	396.3377	646.4448	883.4066	1095.7421	(97)
Space heating kWh	347.4179	225.5512	142.1457	49.2377	11.2225	0.0000	0.0000	0.0000	0.0000	54.7996	181.3658	333.0736	(98a)
Space heating requirement - total per year (kWh/year)												1344.8141	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	347.4179	225.5512	142.1457	49.2377	11.2225	0.0000	0.0000	0.0000	0.0000	54.7996	181.3658	333.0736	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1344.8141	
Space heating per m2											(98c) / (4) =	18.6987	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.9537	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	347.4179	225.5512	142.1457	49.2377	11.2225	0.0000	0.0000	0.0000	0.0000	54.7996	181.3658	333.0736	(98)
Space heating efficiency (main heating system 1)	266.9537	266.9537	266.9537	266.9537	0.0000	0.0000	0.0000	0.0000	266.9537	266.9537	266.9537	266.9537	(210)
Space heating fuel (main heating system)	130.1416	84.4908	53.2473	18.4443	4.2039	0.0000	0.0000	0.0000	0.0000	20.5278	67.9391	124.7683	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.9457	219.2340	232.6631	203.8192	197.1072	177.0870	174.3188	181.4825	183.7563	205.5461	219.3712	245.1264	(64)
Efficiency of water heater												184.1544	(216)
(217)m	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	(217)
Fuel for water heating, kWh/month	134.6401	119.0490	126.3413	110.6784	107.0336	96.1622	94.6590	98.5491	99.7838	111.6162	119.1235	133.1092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.2382	2.0216	2.2382	2.1660	2.2382	2.1660	2.2382	2.2382	2.1660	2.2382	2.1660	2.2382	(231)
Lighting	25.9546	20.8218	18.7477	13.7354	10.6096	8.6681	9.6784	12.5804	16.3407	21.4398	24.2162	26.6760	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												503.7631	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												184.1544	
Water heating fuel used												1350.7455	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												26.3530	(230a)
Total electricity for the above, kWh/year												26.3530	(231)
Electricity for lighting (calculated in Appendix L)												209.4686	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2090.3302	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	403.0105	27.8600	125.7393	(240)
Space heating - main system 1 (low-rate cost)	100.7526	0.1450	14.6091	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	945.5218	31.2000	295.0028	(245)
Low-rate cost	405.2236	14.5000	58.7574	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	26.3530	29.5300	6.9459	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	209.4686	29.5300	61.8561	(250)
Additional standing charges			3.0000	(251)
Total energy cost			565.9106	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	403.0105	0.1655	66.6988	(261)
Space heating - main system 1 (low-rate cost)	100.7526	0.1389	13.9979	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	945.5218	0.1479	139.8445	(264)
Water heating - low rate cost	405.2236	0.1241	50.3007	(264)
Space and water heating			270.8418	(265)
Pumps, fans and electric keep-hot	26.3530	0.1432	3.6567	(267)
Energy for lighting	209.4686	0.1490	31.2150	(268)
Total CO2, kg/year			305.7134	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	403.0105	1.2933	651.5182	(275)
Space heating - main system 1 (low-rate cost)	100.7526	1.5035	151.4839	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	945.5218	1.5529	1468.2636	(278)
Water heating - low rate cost	405.2236	1.4442	585.2287	(278)
Space and water heating			2856.4945	(279)
Pumps, fans and electric keep-hot	26.3530	1.5335	39.8709	(281)
Energy for lighting	209.4686	1.5547	325.6701	(282)
Total Primary energy kWh/year			3222.0355	(286)

SAP 10 EPC IMPROVEMENTS

2B4P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating — Recommended
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.3	-£ 94	-46 kg (15.0%)
U Solar photovoltaic panels	+ 9.9	-£ 321	-265 kg (101.8%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£94	0.64 kg/m²	B 83	A 97
Solar photovoltaic panels	£321	3.68 kg/m²	A 93	A 99
Total Savings	£415	4.32 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£566	£472	£94
Space heating	£150	£174	-£24
Water heating	£354	£236	£118
Lighting	£62	£62	£0
Generated (PV)	-£0	-£321	£321
Total cost of fuels	£566	£151	£415
Total cost of uses	£566	£151	£415
Delivered energy	29 kWh/m²	-4 kWh/m²	33 kWh/m²
Carbon dioxide emissions	0.3 tonnes	-0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	-0 kg/m²	4 kg/m²
Primary energy	45 kWh/m²	12 kWh/m²	33 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600 (1b)	x	2.4000 (2b)	=	86.3040	(1b) - (3b)
First floor	35.9600 (1c)	x	2.6000 (2c)	=	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	179.8000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11455.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.2743	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5691	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	50.6111	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	(38)
Heat transfer coeff	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	(39)
Average = Sum(39)m / 12 =												80.2781	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	(40)
HLP (average)												1.1162	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2918 (42)

Hot water usage for mixer showers

	62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059 (42a)

Hot water usage for baths

	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715 (42b)

Hot water usage for other uses

	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005 (42c)

Average daily hot water use (litres/day) 117.4860 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)
Energy content (annual)											Total = Sum(45)m =	1951.4184	
Distribution loss (46)m = 0.15 x (45)m													
	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.9457	219.2340	231.2674	197.0656	184.3128	164.4802	161.2919	169.3861	178.3534	204.1504	219.3712	245.1264	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												607.4000	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												607.4000	
Solar input	-0.0000	-16.2303	-57.6769	-78.6361	-101.7085	-93.4936	-92.6529	-81.5650	-56.8599	-28.5767	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	247.9457	203.0037	173.5904	118.4295	82.6043	70.9866	68.6390	87.8211	121.4935	175.5737	219.3712	245.1264	(64)
										Total per year (kWh/year) = Sum(64)m =		1814.5851	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	103.7256	92.1193	97.5276	82.9641	76.5864	69.3932	68.8231	71.9495	77.3738	88.5112	93.5380	102.7882	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6524	26.3370	21.4187	16.2153	12.1212	10.2332	11.0573	14.3727	19.2911	24.4944	28.5886	30.4766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.0986	304.2231	296.3495	279.5877	258.4289	238.5426	225.2573	222.1329	230.0064	246.7682	267.9271	287.8134	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)													
	139.4162	137.0823	131.0854	115.2279	102.9387	96.3794	92.5042	96.7063	107.4636	118.9666	129.9139	138.1562	(72)
Total internal gains													
	567.0464	564.5216	545.7329	507.9102	470.3679	442.0343	425.6980	430.0910	453.6402	487.1085	523.3088	553.3253	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	19.6403	0.3900	0.0000	0.7700	79.6226	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	137.5407	269.0588	443.1015	646.2371	791.9878	810.7404	771.8579	663.0146	515.3453	319.2609	171.4971	113.1068	(83)
Total gains	704.5871	833.5803	988.8343	1154.1472	1262.3557	1252.7748	1197.5560	1093.1056	968.9855	806.3694	694.8058	666.4321	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365
alpha	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424
util living area												

	0.9520	0.9173	0.8435	0.7125	0.5523	0.4005	0.2925	0.3335	0.5371	0.7980	0.9244	0.9597	(86)
Living	19.5877	19.8872	20.3044	20.6858	20.8960	20.9747	20.9938	20.9900	20.9295	20.5965	20.0016	19.5049	
Non living	18.3781	18.7471	19.2485	19.6824	19.9006	19.9716	19.9850	19.9831	19.9379	19.6009	18.8965	18.2751	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2775	19.8872	20.3044	20.6858	20.8960	20.9747	20.9938	20.9900	20.9295	20.5965	20.0016	19.7141	(87)
Th 2	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	(88)
util rest of house													
	0.9430	0.9029	0.8187	0.6735	0.5016	0.3405	0.2263	0.2620	0.4688	0.7573	0.9086	0.9520	(89)
MIT 2	19.3460	18.7471	19.2485	19.6824	19.9006	19.9716	19.9850	19.9831	19.9379	19.6009	18.8965	18.5837	(90)
Living area fraction										fLA = Living area / (4) =		0.2632	(91)
MIT	19.5912	19.0472	19.5264	19.9465	20.1626	20.2356	20.2506	20.2482	20.1989	19.8629	19.1874	18.8812	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5912	19.0472	19.5264	19.9465	20.1626	20.2356	20.2506	20.2482	20.1989	19.8629	19.1874	18.8812	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9390	0.8868	0.8060	0.6718	0.5106	0.3554	0.2436	0.2806	0.4836	0.7517	0.8932	0.9414	(94)
Useful gains	661.5859	739.2566	796.9845	775.3200	644.5536	445.2779	291.7453	306.6964	468.5712	606.1823	620.6294	627.3625	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1227.5454	1135.7085	1045.7357	886.7906	679.3595	452.4169	293.0604	308.9239	489.6087	743.6099	970.3508	1178.5823	(97)
Space heating kWh													
	421.0739	266.4157	185.0709	80.2588	25.8956	0.0000	0.0000	0.0000	0.0000	102.2461	251.7994	410.1076	(98a)
Space heating requirement - total per year (kWh/year)												1742.8680	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	421.0739	266.4157	185.0709	80.2588	25.8956	0.0000	0.0000	0.0000	0.0000	102.2461	251.7994	410.1076	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1742.8680	
Space heating per m2											(98c) / (4) =	24.2334	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.9537	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	421.0739	266.4157	185.0709	80.2588	25.8956	0.0000	0.0000	0.0000	0.0000	102.2461	251.7994	410.1076	(98)
Space heating efficiency (main heating system 1)													
	266.9537	266.9537	266.9537	266.9537	266.9537	0.0000	0.0000	0.0000	0.0000	266.9537	266.9537	266.9537	(210)
Space heating fuel (main heating system)													
	157.7330	99.7985	69.3270	30.0647	9.7004	0.0000	0.0000	0.0000	0.0000	38.3011	94.3233	153.6250	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	247.9457	203.0037	173.5904	118.4295	82.6043	70.9866	68.6390	87.8211	121.4935	175.5737	219.3712	245.1264	(64)
Efficiency of water heater												184.1544	(216)
(217)m	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	(217)
Fuel for water heating, kWh/month													
	134.6401	110.2356	94.2635	64.3099	44.8560	38.5473	37.2725	47.6888	65.9737	95.3405	119.1235	133.1092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.0327	8.1586	9.0327	8.7413	9.0327	8.7413	9.0327	9.0327	8.7413	9.0327	8.7413	9.0327	(231)
Lighting	25.9546	20.8218	18.7477	13.7354	10.6096	8.6681	9.6784	12.5804	16.3407	21.4398	24.2162	26.6760	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.4400	-52.8651	-76.8622	-85.5301	-90.1100	-83.1528	-82.0315	-78.0044	-70.1112	-59.9118	-40.3450	-31.2207	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-13.6465	-30.7149	-65.4841	-105.2420	-145.5728	-148.5609	-146.6200	-121.7696	-86.3519	-46.9341	-19.0648	-10.6931	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	652.8729	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.1544	
Water heating fuel used	985.3606	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	26.3530	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	106.3530	(231)
Electricity for lighting (calculated in Appendix L)	209.4686	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	226.8156	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	522.2983	17.5600	102.3705	(240)
Space heating - main system 1 (low-rate cost)	130.5746	0.0940	12.2740	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	689.7524	19.6000	135.1915	(245)
Low-rate cost	295.6082	9.4000	27.7872	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	26.3530	18.5800	4.3857	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	209.4686	18.5800	38.9193	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-786.5847	18.5800	-146.1474	
PV Unit electricity exported	-940.6547	5.5900	-52.5826	
Total			-198.7300	(252)
Total energy cost			144.0620	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4436	(257)
SAP value		92.8097	
SAP rating (Section 12)		93	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	522.2983	0.1645	85.9188	(261)
Space heating - main system 1 (low-rate cost)	130.5746	0.1381	18.0326	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	689.7524	0.1533	105.7169	(264)
Water heating - low rate cost	295.6082	0.1286	38.0284	(264)
Space and water heating			247.6967	(265)
Pumps, fans and electric keep-hot	106.3530	0.1432	15.1129	(267)
Energy for lighting	209.4686	0.1490	31.2150	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-786.5847	0.1391	-109.4146	
PV Unit electricity exported	-940.6547	0.1241	-116.7164	
Total			-226.1309	(269)
Total CO2, kg/year			67.8936	(272)
CO2 emissions per m2			0.9400	(273)
EI value			99.2219	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	35.9600	(1b) x	2.4000	(2b) =	86.3040	(1b) - (3b)
First floor	35.9600	(1c) x	2.6000	(2c) =	93.4960	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.9200					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		179.8000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			23.3200	0.6998	16.3204			(27)
Heatloss Floor 1			35.9600	0.1100	3.9556	75.0000	2697.0000	(28a)
External Wall 1	85.2000	25.2800	59.9200	0.1800	10.7856	60.0000	3595.2000	(29a)
External Roof 1	35.9600		35.9600	0.0900	3.2364	9.0000	323.6400	(30)
Total net area of external elements Aum(A, m2)			157.1200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.0420			(33)
Main dwelling								
Party Wall 1			38.4500	0.0000	0.0000	70.0000	2691.5000	(32)
Internal Wall 1			130.7500			9.0000	1176.7500	(32c)
Internal Floor 1			35.9600			18.0000	647.2800	(32d)
Internal Ceiling 1			35.9600			9.0000	323.6400	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 11455.0100	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	159.2743	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	9.3600	0.0980	0.9173
E12 Gable (insulation at ceiling level)	7.6900	0.0970	0.7459
P1 Party wall - Ground floor	7.6900	0.3200	2.4608
P2 Party wall - Intermediate floor within a dwelling	7.6900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.6900	0.4800	3.6912
E1 Steel lintel with perforated steel base plate	13.1800	0.0500	0.6590
E3 Sill	12.2500	0.0450	0.5513
E4 Jamb	42.0000	0.0510	2.1420
E5 Ground floor (normal)	17.0400	0.0670	1.1417
E6 Intermediate floor within a dwelling	17.0400	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0640	0.6400
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.5691	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	50.6111	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	29.6670	(38)
Heat transfer coeff													
	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	80.2781	(39)
Average = Sum(39)m / 12 =												80.2781	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	1.1162	(40)
HLP (average)												1.1162	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2918	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	62.6460	61.7045	60.3326	57.7078	55.7707	53.6106	52.3827	53.7442	55.2366	57.5560	60.2372	62.4059	(42a)
Hot water usage for baths													
	27.0630	26.6611	26.0951	25.0515	24.2701	23.4036	22.9356	23.4976	24.1096	25.0367	26.1018	26.9715	(42b)
Hot water usage for other uses													
	38.1005	36.7151	35.3296	33.9441	32.5586	31.1732	31.1732	32.5586	33.9441	35.3296	36.7151	38.1005	(42c)
Average daily hot water use (litres/day)												117.4860	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	127.8095	125.0807	121.7573	116.7035	112.5995	108.1873	106.4915	109.8005	113.2903	117.9224	123.0541	127.4780	(44)
Energy conte	202.4191	178.1132	187.1365	159.7612	151.5806	133.0290	128.7922	135.9559	139.6983	160.0195	175.3132	199.5998	(45)
Energy content (annual)										Total = Sum(45)m =		1951.4184	
Distribution loss (46)m = 0.15 x (45)m													
	30.3629	26.7170	28.0705	23.9642	22.7371	19.9543	19.3188	20.3934	20.9547	24.0029	26.2970	29.9400	(46)

Water storage loss:		
Store volume	210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3300	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7182	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	247.9457	219.2340	231.2674	197.0656	184.3128	164.4802	161.2919	169.3861	178.3534	204.1504	219.3712	245.1264	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector											3.0000	(H1)
Zero-loss collector efficiency											0.8000	(H2)
Collector linear heat loss coefficient											1.8000	(H3)
Collector 2nd order heat loss coefficient											0.0000	(H4)
Collector loop efficiency											0.9000	(H5)
Incidence angle modifier											1.0000	(H6)
Overshading factor											0.8000	(H8)
Overall heat loss coefficient of system											6.5000	(H10)
Heat loss coefficient of collector loop											3.9667	(H11)
Dedicated solar storage volume											75.0000	(H12)
Effective solar volume											75.0000	(H14)
Reference volume											225.0000	(H15)
Storage tank correction coefficient											1.3161	(H16)
Heat delivered to hot water											761.8235	(H24)
Heat delivered to space heating											0.0000	(H29)
Solar input											761.8235	
Solar input	-6.5070	-23.9184	-68.9440	-93.9766	-114.3766	-112.1578	-111.4354	-100.7789	-74.6503	-44.3087	-10.7697	-0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h												
	241.4387	195.3156	162.3234	103.0889	69.9362	52.3224	49.8564	68.6072	103.7031	159.8417	208.6015	245.1264 (64)
									Total per year (kWh/year) = Sum(64)m =			1660.1615 (64)
Electric shower(s)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000 (64a)
Heat gains from water heating, kWh/month												
	103.7256	92.1193	97.5276	82.9641	76.5864	69.3932	68.8231	71.9495	77.3738	88.5112	93.5380	102.7882 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	137.5092	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	29.6524	26.3370	21.4187	16.2153	12.1212	10.2332	11.0573	14.3727	19.2911	24.4944	28.5886	30.4766	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	301.0986	304.2231	296.3495	279.5877	258.4289	238.5426	225.2573	222.1329	230.0064	246.7682	267.9271	287.8134	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	51.0427	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	-91.6728	(71)
Water heating gains (Table 5)													
	139.4162	137.0823	131.0854	115.2279	102.9387	96.3794	92.5042	96.7063	107.4636	118.9666	129.9139	138.1562	(72)
Total internal gains													
	567.0464	564.5216	545.7329	507.9102	470.3679	442.0343	425.6980	430.0910	453.6402	487.1085	523.3088	553.3253	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	13.5000	26.6540	0.3900	0.0000	0.7700	108.0568	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	186.6581	308.0245	499.3604	743.8263	877.3356	959.7261	917.7786	792.5182	622.1906	389.5308	224.1862	153.0537	(83)
Total gains	753.7045	872.5460	1045.0933	1251.7364	1347.7035	1401.7604	1343.4766	1222.6092	1075.8308	876.6393	747.4950	706.3789	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	39.6365	
alpha	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	3.6424	
util living area													
	0.9320	0.8952	0.8014	0.6369	0.4592	0.2953	0.1968	0.2160	0.4143	0.7032	0.8829	0.9407	(86)
Living	19.8237	20.0573	20.4640	20.8022	20.9508	20.9925	20.9988	20.9983	20.9749	20.7765	20.2757	19.7776	
Non living	18.6720	18.9551	19.4343	19.8051	19.9506	19.9838	19.9873	19.9872	19.9731	19.7929	19.2287	18.6168	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3982	20.0573	20.4640	20.8022	20.9508	20.9925	20.9988	20.9983	20.9749	20.7765	20.2757	19.9486	(87)
Th 2	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	19.9876	(88)
util rest of house													
	0.9192	0.8771	0.7712	0.5931	0.4061	0.2388	0.1366	0.1501	0.3448	0.6494	0.8585	0.9291	(89)
MIT 2	19.4631	18.9551	19.4343	19.8051	19.9506	19.9838	19.9873	19.9872	19.9731	19.7929	19.2287	18.8638	(90)
Living area fraction									fLA = Living area / (4) =			0.2632	(91)
MIT	19.7093	19.2452	19.7053	20.0676	20.2139	20.2493	20.2535	20.2533	20.2368	20.0518	19.5043	19.1493	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7093	19.2452	19.7053	20.0676	20.2139	20.2493	20.2535	20.2533	20.2368	20.0518	19.5043	19.1493	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9152	0.8615	0.7620	0.5967	0.4182	0.2535	0.1524	0.1674	0.3622	0.6530	0.8448	0.9174	(94)
Useful gains	689.7882	751.7402	796.3298	746.8778	563.5767	355.3480	204.8089	204.7214	389.6616	572.4564	631.5096	648.0625	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1156.7477	1087.3819	987.8466	816.2320	579.1150	357.1807	204.9933	204.9767	396.3141	646.3815	883.4066	1095.7421	(97)
Space heating kWh													
	347.4179	225.5512	142.4885	49.9350	11.5605	0.0000	0.0000	0.0000	0.0000	55.0003	181.3658	333.0736	(98a)
Space heating requirement - total per year (kWh/year)												1346.3929	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)

Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	347.4179	225.5512	142.4885	49.9350	11.5605	0.0000	0.0000	0.0000	0.0000	55.0003	181.3658	333.0736	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1346.3929	
Space heating per m2											(98c) / (4) =	18.7207	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.9537	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	347.4179	225.5512	142.4885	49.9350	11.5605	0.0000	0.0000	0.0000	0.0000	55.0003	181.3658	333.0736	(98)
Space heating efficiency (main heating system 1)													
	266.9537	266.9537	266.9537	266.9537	266.9537	0.0000	0.0000	0.0000	0.0000	266.9537	266.9537	266.9537	(210)
Space heating fuel (main heating system)													
	130.1416	84.4908	53.3757	18.7055	4.3305	0.0000	0.0000	0.0000	0.0000	20.6029	67.9391	124.7683	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	241.4387	195.3156	162.3234	103.0889	69.9362	52.3224	49.8564	68.6072	103.7031	159.8417	208.6015	245.1264	(64)
Efficiency of water heater												184.1544	(216)
(217)m	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	184.1544	(217)
Fuel for water heating, kWh/month													
	131.1066	106.0608	88.1453	55.9796	37.9770	28.4123	27.0732	37.2553	56.3131	86.7976	113.2753	133.1092	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.0327	8.1586	9.0327	8.7413	9.0327	8.7413	9.0327	9.0327	8.7413	9.0327	8.7413	9.0327	(231)
Lighting	25.9546	20.8218	18.7477	13.7354	10.6096	8.6681	9.6784	12.5804	16.3407	21.4398	24.2162	26.6760	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-45.6933	-57.2544	-81.3327	-90.2905	-92.8877	-88.0447	-86.9637	-83.5667	-76.6157	-66.5608	-48.3824	-39.2293	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.9765	-36.7673	-76.9275	-127.4346	-166.9208	-185.2995	-183.8115	-153.5998	-110.1213	-61.7056	-27.8239	-16.3808	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												504.3545	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												184.1544	
Water heating fuel used												901.5052	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												26.3530	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												106.3530	(231)
Electricity for lighting (calculated in Appendix L)												209.4686	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2024.5910	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												-302.9097	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	403.4836	27.8600	125.8869	(240)
Space heating - main system 1 (low-rate cost)	100.8709	0.1450	14.6263	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	631.0536	31.2000	196.8887	(245)
Low-rate cost	270.4515	14.5000	39.2155	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	26.3530	29.5300	6.9459	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	209.4686	29.5300	61.8561	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.8219	29.5300	-253.0195	
PV Unit electricity exported	-1167.7691	5.8100	-67.8474	
Total			-320.8669	(252)
Total energy cost			151.1764	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	403.4836	0.1655	66.7693	(261)
Space heating - main system 1 (low-rate cost)	100.8709	0.1389	14.0127	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	631.0536	0.1547	97.6228	(264)
Water heating - low rate cost	270.4515	0.1299	35.1181	(264)
Space and water heating			213.5228	(265)
Pumps, fans and electric keep-hot	106.3530	0.1432	15.1129	(267)
Energy for lighting	209.4686	0.1490	31.2150	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.8219	0.1396	-119.6518	
PV Unit electricity exported	-1167.7691	0.1242	-144.9849	
Total			-264.6367	(269)
Total CO2, kg/year			-4.7860	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	403.4836	1.2932	652.2551	(275)
Space heating - main system 1 (low-rate cost)	100.8709	1.5035	151.6553	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	631.0536	1.5775	995.4820	(278)
Water heating - low rate cost	270.4515	1.4672	396.7950	(278)
Space and water heating			2196.1873	(279)
Pumps, fans and electric keep-hot	106.3530	1.5335	162.5497	(281)
Energy for lighting	209.4686	1.5547	325.6701	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.8219	1.5205	-1302.8009	
PV Unit electricity exported	-1167.7691	0.4556	-531.9854	
Total			-1834.7863	(283)
Total Primary energy kWh/year			849.6208	(286)

Full SAP Calculation Printout

Property Reference	HT 10 Havant	**Issued on Date**	22/06/2025
Assessment Reference	3B4P ASHP	**Prop Type Ref**	3B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.40	**TER**	11.31
Environmental	96 A	**% DER < TER**			61.10
CO_2 Emissions (t/year)	0.31	**DFEE**	33.84	**TFEE**	36.21
Compliance Check	See BREL	**% DFEE < TFEE**			6.56
% DPER < TPER	21.59	**DPER**	46.21	**TPER**	58.94

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800 (1b)	x	2.4000 (2b)	=	94.5120	(1b) - (3b)
First floor	39.3800 (1c)	x	2.6000 (2c)	=	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.9000	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.2000	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12893.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	163.7042	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1563 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	(38)
Heat transfer coeff	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	(39)

Average = Sum(39)m / 12 = 81.4556

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	(40)
HLP (average)												1.0342	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4389 (42)

Hot water usage for mixer showers

65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day) 122.1126 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)

Energy content (annual) Total = Sum(45)m = 2028.2648

Distribution loss (46)m = 0.15 x (45)m

31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)

Total per year (kWh/year) = Sum(64)m = 2564.3038 (64)

12Total per year (kWh/year) 2564 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

106.3761	94.4515	101.0944	90.4588	88.8065	81.2203	80.9310	83.4068	83.5253	91.7231	95.8336	105.4018	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.3655	121.0833	109.3655	113.0111	109.3655	113.0111	109.3655	109.3655	113.0111	109.3655	113.0111	109.3655	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.8294	219.0794	213.4095	201.3388	186.1018	171.7811	162.2140	159.9640	165.6340	177.7046	192.9417	207.2623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)
Water heating gains (Table 5)	142.9786	140.5528	135.8796	125.6373	119.3636	112.8060	108.7783	112.1059	116.0074	123.2837	133.1022	141.6691	(72)
Total internal gains	528.7573	540.2992	518.2383	499.5708	474.4146	457.1818	439.9415	441.0192	454.2361	469.9376	498.6386	517.8806	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	19.6403	0.3900	0.0000	0.7700	72.1322	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	130.0503	254.4059	418.9703	611.0432	748.8564	766.5877	729.8228	626.9070	487.2798	301.8740	162.1574	106.9470	(83)

Total gains	658.8076	794.7051	937.2086	1110.6140	1223.2710	1223.7696	1169.7643	1067.9261	941.5159	771.8116	660.7960	624.8277	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	
alpha	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	
util living area													
	0.9693	0.9399	0.8777	0.7471	0.5797	0.4173	0.3044	0.3471	0.5626	0.8325	0.9461	0.9745	(86)
Living	19.6087	19.9118	20.3089	20.6995	20.9067	20.9796	20.9954	20.9923	20.9376	20.6056	20.0225	19.5358	
Non living	18.4502	18.8272	19.3101	19.7594	19.9760	20.0418	20.0530	20.0514	20.0103	19.6702	18.9714	18.3586	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2883	19.9118	20.3089	20.6995	20.9067	20.9796	20.9954	20.9923	20.9376	20.6056	20.0225	19.7406	(87)
Th 2	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	(88)
util rest of house													
	0.9632	0.9288	0.8568	0.7106	0.5303	0.3587	0.2399	0.2774	0.4960	0.7964	0.9341	0.9694	(89)
MIT 2	19.4152	18.8272	19.3101	19.7594	19.9760	20.0418	20.0530	20.0514	20.0103	19.6702	18.9714	18.6643	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	19.6391	19.1054	19.5663	20.0005	20.2147	20.2823	20.2947	20.2927	20.2482	19.9101	19.2410	18.9403	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6391	19.1054	19.5663	20.0005	20.2147	20.2823	20.2947	20.2927	20.2482	19.9101	19.2410	18.9403	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9601	0.9152	0.8445	0.7083	0.5389	0.3730	0.2564	0.2951	0.5101	0.7901	0.9212	0.9617	(94)
Useful gains	632.5330	727.3068	791.4935	786.6827	659.2073	456.5055	299.8751	315.1958	480.2923	609.8422	608.7321	600.8850	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1249.4541	1157.1071	1064.3212	904.1989	693.5726	462.8545	300.9515	317.0841	500.8018	758.3613	988.9522	1200.6814	(97)
Space heating kWh													
	458.9893	288.8258	202.9838	84.6116	25.5678	0.0000	0.0000	0.0000	0.0000	110.4982	273.7585	446.2485	(98a)
Space heating requirement - total per year (kWh/year)												1891.4835	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	458.9893	288.8258	202.9838	84.6116	25.5678	0.0000	0.0000	0.0000	0.0000	110.4982	273.7585	446.2485	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1891.4835	
Space heating per m2											(98c) / (4) =	24.0158	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.4448	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	458.9893	288.8258	202.9838	84.6116	25.5678	0.0000	0.0000	0.0000	0.0000	110.4982	273.7585	446.2485	(98)
Space heating efficiency (main heating system 1)													
	266.4448	266.4448	266.4448	266.4448	266.4448	0.0000	0.0000	0.0000	0.0000	266.4448	266.4448	266.4448	(210)
Space heating fuel (main heating system)													
	172.2643	108.3999	76.1823	31.7558	9.5959	0.0000	0.0000	0.0000	0.0000	41.4713	102.7449	167.4825	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)
Efficiency of water heater												184.0555	(216)
(217)m	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	(217)
Fuel for water heating, kWh/month													
	139.0434	122.9238	130.4130	114.1560	110.3342	99.0600	97.4654	101.5109	102.8264	115.1000	122.9385	137.4513	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.4511	2.2139	2.4511	2.3720	2.4511	2.3720	2.4511	2.4511	2.3720	2.4511	2.3720	2.4511	(231)
Lighting	27.7805	22.2865	20.0666	14.7016	11.3560	9.2779	10.3593	13.4654	17.4902	22.9481	25.9198	28.5526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												709.8969	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												184.0555	
Water heating fuel used												1393.2230	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.8593	(230a)
Total electricity for the above, kWh/year	28.8593	(231)
Electricity for lighting (calculated in Appendix L)	224.2045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2356.1837	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	567.9175	0.1646	93.4599	(261)
Space heating - main system 1 (low-rate cost)	141.9794	0.1382	19.6152	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	975.2561	0.1479	144.2612	(264)
Water heating - low rate cost	417.9669	0.1241	51.8893	(264)
Space and water heating			309.2257	(265)
Pumps, fans and electric keep-hot	28.8593	0.1432	4.0044	(267)
Energy for lighting	224.2045	0.1490	33.4109	(268)
Total CO2, kg/year			346.6410	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.4000	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	567.9175	1.2906	916.2124	(275)
Space heating - main system 1 (low-rate cost)	141.9794	1.5004	213.0293	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	975.2561	1.5529	1514.5056	(278)
Water heating - low rate cost	417.9669	1.4443	603.6601	(278)
Space and water heating			3247.4075	(279)
Pumps, fans and electric keep-hot	28.8593	1.5335	43.6628	(281)
Energy for lighting	224.2045	1.5547	348.5807	(282)
Total Primary energy kWh/year			3639.6510	(286)
Dwelling Primary energy Rate (DPER)			46.2100	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800 (1b)	x	2.4000 (2b)	=	94.5120	(1b) - (3b)
First floor	39.3800 (1c)	x	2.6000 (2c)	=	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 78.7600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.9000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1524	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4024	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3420	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4361	0.4275	0.4190	0.3762	0.3677	0.3249	0.3249	0.3164	0.3420	0.3677	0.3848	0.4019	(22b)

Effective ac	0.5951	0.5914	0.5878	0.5708	0.5676	0.5528	0.5528	0.5500	0.5585	0.5676	0.5740	0.5807 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.7300	1.1450	20.3015			(27)
Heatloss Floor 1			39.2800	0.1300	5.1064			(28a)
External Wall 1	89.4000	19.6900	69.7100	0.1800	12.5478			(29a)
External Roof 1	39.3800		39.3800	0.1100	4.3318			(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.2475			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	163.7042	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.0000	0.0600	0.6000
E12 Gable (insulation at ceiling level)	7.9100	0.0600	0.4746
P1 Party wall - Ground floor	7.9100	0.0800	0.6328
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.1200	0.9492
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0500	0.5825
E4 Jamb	37.8000	0.0500	1.8900

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7581	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	50.0056	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6661	38.4262	38.1911	37.0867	36.8800	35.9181	35.9181	35.7400	36.2886	36.8800	37.2981	37.7351	(38)
Heat transfer coeff	88.6717	88.4319	88.1967	87.0923	86.8857	85.9238	85.9238	85.7456	86.2943	86.8857	87.3037	87.7407	(39)
Average = Sum(39)m / 12 =												87.0913	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1258	1.1228	1.1198	1.1058	1.1032	1.0910	1.0910	1.0887	1.0957	1.1032	1.1085	1.1140	(40)
HLP (average)												1.1058	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.4389	(42)
Hot water usage for mixer showers												
65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)
Hot water usage for baths												
28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)
Hot water usage for other uses												
39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)
Average daily hot water use (litres/day)												122.1126	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)
Energy content (annual)										Total = Sum(45)m =		2028.2648	
Distribution loss (46)m = 0.15 x (45)m													
	31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9188	(55)
Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.1370	231.8661	246.2523	216.1298	209.2962	188.3447	185.6105	193.0564	195.2771	218.0678	232.2944	259.2068	(62)
WWHRS	-29.7666	-26.3258	-27.5669	-22.8265	-21.2734	-18.2038	-17.0632	-18.1450	-18.8344	-22.2037	-25.1541	-29.2154	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	232.3704	205.5403	218.6854	193.3033	188.0227	170.1409	168.5473	174.9114	176.4427	195.8641	207.1404	229.9914	(64)
										Total per year (kWh/year) = Sum(64)m =		2360.9604	(64)
12Total per year (kWh/year)												2361	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	111.3521	98.9459	106.0704	95.2743	93.7825	86.0358	85.9070	88.3828	88.3408	96.6991	100.6491	110.3778	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.3495	121.0655	109.3495	112.9945	109.3495	112.9945	109.3495	109.3495	112.9945	109.3495	112.9945	109.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	216.8294	219.0794	213.4095	201.3388	186.1018	171.7811	162.2140	159.9640	165.6340	177.7046	192.9417	207.2623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													

	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)
Water heating gains (Table 5)													
	149.6668	147.2409	142.5678	132.3254	126.0517	119.4941	115.4664	118.7941	122.6955	129.9719	139.7904	148.3572	(72)
Total internal gains													
	538.4294	549.9696	527.9105	509.2424	484.0867	463.8534	446.6136	447.6913	460.9077	479.6097	508.3102	527.5528	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(76)
West	7.8900	19.6403	0.6300	0.7000	0.7700	47.3583	(80)

Solar gains	106.4211	208.1823	342.8466	500.0213	612.7949	627.3047	597.2196	513.0028	398.7448	247.0259	132.6946	87.5156	(83)
Total gains	644.8506	758.1519	870.7571	1009.2638	1096.8817	1091.1581	1043.8332	960.6941	859.6525	726.6356	641.0049	615.0683	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3904	40.4999	40.6079	41.1228	41.2206	41.6821	41.6821	41.7687	41.5031	41.2206	41.0233	40.8189	
alpha	3.6927	3.7000	3.7072	3.7415	3.7480	3.7788	3.7788	3.7846	3.7669	3.7480	3.7349	3.7213	
util living area													
	0.9732	0.9521	0.9082	0.8058	0.6561	0.4845	0.3572	0.4021	0.6280	0.8658	0.9543	0.9771	(86)
MIT	19.3932	19.6771	20.0795	20.5447	20.8326	20.9596	20.9901	20.9846	20.8946	20.4801	19.8616	19.3509	(87)
Th 2	19.9798	19.9823	19.9847	19.9961	19.9982	20.0082	20.0082	20.0101	20.0044	19.9982	19.9939	19.9894	(88)
util rest of house													
	0.9677	0.9426	0.8904	0.7716	0.6032	0.4160	0.2789	0.3192	0.5560	0.8328	0.9435	0.9723	(89)
MIT 2	18.1279	18.4849	18.9828	19.5405	19.8540	19.9819	20.0040	20.0030	19.9276	19.4844	18.7296	18.0811	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	18.4524	18.7907	19.2641	19.7980	20.1050	20.2327	20.2569	20.2548	20.1756	19.7398	19.0200	18.4067	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4524	18.7907	19.2641	19.7980	20.1050	20.2327	20.2569	20.2548	20.1756	19.7398	19.0200	18.4067	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9565	0.9284	0.8754	0.7642	0.6091	0.4319	0.2988	0.3400	0.5691	0.8229	0.9301	0.9621	(94)
Useful gains	616.7975	703.8575	762.2561	771.2905	668.1355	471.2419	311.8551	326.6818	489.2127	597.9713	596.1924	591.7483	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1254.9193	1228.3812	1125.7498	949.1333	730.2702	483.9807	314.2145	330.5281	524.2899	794.1146	1040.6561	1246.5101	(97)
Space heating kWh													
	474.7626	352.4799	270.4393	128.0469	46.2282	0.0000	0.0000	0.0000	0.0000	145.9306	320.0139	487.1428	(98a)
Space heating requirement - total per year (kWh/year)												2225.0442	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	474.7626	352.4799	270.4393	128.0469	46.2282	0.0000	0.0000	0.0000	0.0000	145.9306	320.0139	487.1428	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2225.0442	
Space heating per m2											(98c) / (4) =	28.2509	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	474.7626	352.4799	270.4393	128.0469	46.2282	0.0000	0.0000	0.0000	0.0000	145.9306	320.0139	487.1428	(98)
Space heating efficiency (main heating system 1)													
	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)													
	514.3691	381.8850	293.0004	138.7290	50.0847	0.0000	0.0000	0.0000	0.0000	158.1047	346.7106	527.7820	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	232.3704	205.5403	218.6854	193.3033	188.0227	170.1409	168.5473	174.9114	176.4427	195.8641	207.1404	229.9914	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6266	85.2582	84.5373	83.1583	81.4287	79.8000	79.8000	79.8000	79.8000	83.4093	85.0317	85.7002	(217)
Fuel for water heating, kWh/month													
	271.3765	241.0798	258.6852	232.4520	230.9048	213.2091	211.2122	219.1873	221.1061	234.8229	243.6038	268.3674	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	22.7207	18.2274	16.4117	12.0239	9.2876	7.5881	8.4725	11.0129	14.3046	18.7684	21.1989	23.3521	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.7182	-51.7051	-74.2434	-83.3944	-89.8625	-83.8548	-82.8074	-78.1919	-70.0548	-59.0660	-40.3408	-31.7513	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.9418	-44.0294	-87.4663	-131.3066	-173.5639	-174.3729	-172.3312	-145.9504	-107.0208	-62.9599	-27.9581	-16.5632	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2410.6655	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2846.0071	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	183.3688	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1946.4552	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3579.5862	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2410.6655	0.2100	506.2397	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2846.0071	0.2100	597.6615	(264)
Space and water heating			1103.9012	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.3688	0.1443	26.4658	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-781.9905	0.1346	-105.2626	
PV Unit electricity exported	-1164.4647	0.1259	-146.6165	
Total			-251.8791	(269)
Total CO2, kg/year			890.4172	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.3100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2410.6655	1.1300	2724.0520	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2846.0071	1.1300	3215.9880	(278)
Space and water heating			5940.0400	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.3688	1.5338	281.2572	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-781.9905	1.4975	-1171.0243	
PV Unit electricity exported	-1164.4647	0.4622	-538.1839	
Total			-1709.2083	(283)
Total Primary energy kWh/year			4642.1897	(286)
Target Primary Energy Rate (TPER)			58.9400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		39.3800	(1b) x	2.4000	(2b) =	94.5120	(1b) - (3b)
First floor		39.3800	(1c) x	2.6000	(2c) =	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.9000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)

Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1524 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3524 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2995 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3819	0.3744	0.3669	0.3295	0.3220	0.2845	0.2845	0.2770	0.2995	0.3220	0.3369	0.3519	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.0000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		0.0000 (23c)
Effective ac	0.5729 0.5701 0.5673 0.5543 0.5518 0.5405 0.5405 0.5384 0.5449 0.5518 0.5568 0.5619	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12893.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.7042 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1563 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2262	37.0422	36.8619	36.0149	35.8564	35.1187	35.1187	34.9821	35.4029	35.8564	36.1770	36.5122	(38)
Heat transfer coeff	86.1933	86.0093	85.8290	84.9820	84.8235	84.0858	84.0858	83.9492	84.3700	84.8235	85.1441	85.4792	(39)

Average = Sum(39)m / 12 =		84.9812

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0944	1.0920	1.0898	1.0790	1.0770	1.0676	1.0676	1.0659	1.0712	1.0770	1.0811	1.0853	(40)
HLP (average)												1.0790	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4389 (42)

Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day)		62.0813 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	67.7305	65.8726	63.8442	61.3194	59.0671	56.7264	56.2401	58.2644	60.3406	62.7443	65.2914	67.6354	(44)
Energy conte	107.2686	93.8017	98.1261	83.9432	79.5157	69.7518	68.0175	72.1435	74.4059	85.1434	93.0195	105.9008	(45)

Energy content (annual)	Total = Sum(45)m =	1031.0377

Distribution loss (46)m = 0.15 x (45)m

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

91.1783	79.7314	83.4072	71.3517	67.5883	59.2890	57.8149	61.3219	63.2451	72.3719	79.0666	90.0156	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

91.1783	79.7314	83.4072	71.3517	67.5883	59.2890	57.8149	61.3219	63.2451	72.3719	79.0666	90.0156	(64)

	Total per year (kWh/year) = Sum(64)m =	876.3820 (64)
12Total per year (kWh/year)		876 (64)

Electric shower(s)

	52.1441	46.4608	50.7334	48.4143	49.3227	47.0491	48.6174	49.3227	48.4143	50.7334	49.7794	52.1441 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												593.1355 (64a)

Heat gains from water heating, kWh/month

	35.8306	31.5481	33.5351	29.9415	29.2278	26.5845	26.6081	27.6612	27.9148	30.7763	32.2115	35.5399 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	109.3655	121.0833	109.3655	113.0111	109.3655	113.0111	109.3655	109.3655	113.0111	109.3655	113.0111	109.3655	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	216.8294	219.0794	213.4095	201.3388	186.1018	171.7811	162.2140	159.9640	165.6340	177.7046	192.9417	207.2623	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)

Water heating gains (Table 5)

	48.1594	46.9465	45.0741	41.5854	39.2846	36.9230	35.7635	37.1790	38.7706	41.3660	44.7382	47.7687	(72)

Total internal gains

	433.9381	446.6929	427.4328	415.5190	394.3356	381.2988	366.9268	366.0922	376.9993	388.0199	410.2746	423.9803	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	19.6403	0.3900	0.0000	0.7700	72.1322	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	130.0503	254.4059	418.9703	611.0432	748.8564	766.5877	729.8228	626.9070	487.2798	301.8740	162.1574	106.9470	(83)
Total gains	563.9883	701.0988	846.4031	1026.5622	1143.1920	1147.8866	1096.7496	992.9992	864.2791	689.8939	572.4320	530.9273	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.5518	41.6407	41.7281	42.1440	42.2228	42.5932	42.5932	42.6625	42.4497	42.2228	42.0638	41.8989	
alpha	3.7701	3.7760	3.7819	3.8096	3.8149	3.8395	3.8395	3.8442	3.8300	3.8149	3.8043	3.7933	
util living area	0.9820	0.9607	0.9116	0.7927	0.6276	0.4549	0.3339	0.3825	0.6167	0.8770	0.9664	0.9854	(86)
MIT	19.3189	19.6491	20.1011	20.5913	20.8640	20.9694	20.9927	20.9879	20.9062	20.4716	19.7994	19.2631	(87)
Th 2	20.0054	20.0073	20.0092	20.0180	20.0197	20.0274	20.0274	20.0288	20.0244	20.0197	20.0163	20.0128	(88)
util rest of house	0.9782	0.9527	0.8944	0.7580	0.5757	0.3906	0.2616	0.3045	0.5461	0.8461	0.9582	0.9823	(89)
MIT 2	18.4829	18.8080	19.2444	19.7004	19.9290	20.0120	20.0250	20.0245	19.9712	19.6092	18.9663	18.4333	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	18.6973	19.0237	19.4641	19.9289	20.1688	20.2575	20.2732	20.2716	20.2110	19.8304	19.1800	18.6461	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6973	19.0237	19.4641	19.9289	20.1688	20.2575	20.2732	20.2716	20.2110	19.8304	19.1800	18.6461	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9714	0.9428	0.8834	0.7546	0.5840	0.4061	0.2801	0.3243	0.5603	0.8392	0.9492	0.9764	(94)
Useful gains	547.8788	660.9915	747.7395	774.6463	667.5717	466.1177	307.1477	322.0160	484.2377	578.9837	543.3773	518.3934	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1240.9539	1214.7705	1112.6967	937.2555	718.3548	475.7177	308.8616	325.0156	515.5857	782.9548	1028.5411	1234.8446	(97)
Space heating kWh	515.6479	372.1395	271.5282	117.0786	37.7826	0.0000	0.0000	0.0000	0.0000	151.7545	349.3180	533.0397	(98a)
Space heating requirement - total per year (kWh/year)												2348.2890	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	515.6479	372.1395	271.5282	117.0786	37.7826	0.0000	0.0000	0.0000	0.0000	151.7545	349.3180	533.0397	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2348.2890	
Space heating per m2											(98c) / (4) =	29.8158	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	790.4066	622.2350	638.0139	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9362	0.9636	0.9475	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	739.9841	599.5867	604.4941	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1299.7440	1242.1040	1122.9702	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	403.0271	478.0329	385.7462	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	100.7568	119.5082	96.4366	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												316.7016	(107)

Energy for space heating		29.8158 (99)
Energy for space cooling		4.0211 (108)
Total		33.8369 (109)
Fabric Energy Efficiency (DFEE)		33.8 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800 (1b)	x	2.4000 (2b)	=	94.5120	(1b) - (3b)
First floor	39.3800 (1c)	x	2.6000 (2c)	=	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.9000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1524	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4024	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3420	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4361	0.4275	0.4190	0.3762	0.3677	0.3249	0.3249	0.3164	0.3420	0.3677	0.3848	0.4019	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5951	0.5914	0.5878	0.5708	0.5676	0.5528	0.5528	0.5500	0.5585	0.5676	0.5740	0.5807	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.7300	1.1450	20.3015			(27)
Heatloss Floor 1			39.2800	0.1300	5.1064			(28a)
External Wall 1	89.4000	19.6900	69.7100	0.1800	12.5478			(29a)
External Roof 1	39.3800		39.3800	0.1100	4.3318			(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.2475			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K			163.7042 (35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.0000	0.0600	0.6000
E12 Gable (insulation at ceiling level)	7.9100	0.0600	0.4746
P1 Party wall - Ground floor	7.9100	0.0800	0.6328
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.1200	0.9492
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0500	0.5825
E4 Jamb	37.8000	0.0500	1.8900
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.7581 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =		50.0056 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.6661	38.4262	38.1911	37.0867	36.8800	35.9181	35.9181	35.7400	36.2886	36.8800	37.2981	37.7351	(38)
Heat transfer coeff	88.6717	88.4319	88.1967	87.0923	86.8857	85.9238	85.9238	85.7456	86.2943	86.8857	87.3037	87.7407	(39)
Average = Sum(39)m / 12 =												87.0913	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1258	1.1228	1.1198	1.1058	1.1032	1.0910	1.0910	1.0887	1.0957	1.1032	1.1085	1.1140	(40)
HLP (average)												1.1058	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4389	(42)
Hot water usage for mixer showers													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													
	28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)
Hot water usage for other uses													
	39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)
Average daily hot water use (litres/day)												62.0813	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	67.7305	65.8726	63.8442	61.3194	59.0671	56.7264	56.2401	58.2644	60.3406	62.7443	65.2914	67.6354	(44)
Energy conte	107.2686	93.8017	98.1261	83.9432	79.5157	69.7518	68.0175	72.1435	74.4059	85.1434	93.0195	105.9008	(45)
Energy content (annual)										Total = Sum(45)m =		1031.0377	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	91.1783	79.7314	83.4072	71.3517	67.5883	59.2890	57.8149	61.3219	63.2451	72.3719	79.0666	90.0156	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	91.1783	79.7314	83.4072	71.3517	67.5883	59.2890	57.8149	61.3219	63.2451	72.3719	79.0666	90.0156	(64)
										Total per year (kWh/year) = Sum(64)m =		876.3820	(64)
12Total per year (kWh/year)												876	(64)
Electric shower(s)													
	52.1441	46.4608	50.7334	48.4143	49.3227	47.0491	48.6174	49.3227	48.4143	50.7334	49.7794	52.1441	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		593.1355	(64a)
Heat gains from water heating, kWh/month													
	35.8306	31.5481	33.5351	29.9415	29.2278	26.5845	26.6081	27.6612	27.9148	30.7763	32.2115	35.5399	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	121.9456	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.3495	121.0655	109.3495	112.9945	109.3495	112.9945	109.3495	109.3495	112.9945	109.3495	112.9945	109.3495	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	216.8294	219.0794	213.4095	201.3388	186.1018	171.7811	162.2140	159.9640	165.6340	177.7046	192.9417	207.2623	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	35.1946	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)
Water heating gains (Table 5)													
	48.1594	46.9465	45.0741	41.5854	39.2846	36.9230	35.7635	37.1790	38.7706	41.3660	44.7382	47.7687	(72)
Total internal gains													
	433.9220	446.6752	427.4168	415.5024	394.3196	381.2822	366.9107	366.0762	376.9827	388.0039	410.2581	423.9643	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.8400	19.6403	0.6300	0.7000	0.7700	59.0628	(76)
West	7.8900	19.6403	0.6300	0.7000	0.7700	47.3583	(80)

Solar gains	106.4211	208.1823	342.8466	500.0213	612.7949	627.3047	597.2196	513.0028	398.7448	247.0259	132.6946	87.5156	(83)
Total gains	540.3431	654.8575	770.2634	915.5238	1007.1145	1008.5869	964.1303	879.0790	775.7275	635.0297	542.9527	511.4798	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.3904	40.4999	40.6079	41.1228	41.2206	41.6821	41.6821	41.7687	41.5031	41.2206	41.0233	40.8189	
alpha	3.6927	3.7000	3.7072	3.7415	3.7480	3.7788	3.7788	3.7846	3.7669	3.7480	3.7349	3.7213	
util living area													
	0.9845	0.9687	0.9331	0.8407	0.6952	0.5187	0.3851	0.4365	0.6757	0.9025	0.9720	0.9872	(86)
MIT	19.2131	19.5122	19.9436	20.4622	20.7957	20.9492	20.9872	20.9796	20.8647	20.3740	19.7028	19.1695	(87)
Th 2	19.9798	19.9823	19.9847	19.9961	19.9982	20.0082	20.0082	20.0101	20.0044	19.9982	19.9939	19.9894	(88)
util rest of house													
	0.9811	0.9620	0.9191	0.8099	0.6428	0.4471	0.3014	0.3477	0.6033	0.8757	0.9649	0.9844	(89)
MIT 2	18.3598	18.6559	19.0768	19.5704	19.8589	19.9821	20.0039	20.0027	19.9256	19.5049	18.8556	18.3236	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	18.5786	18.8755	19.2991	19.7991	20.0991	20.2301	20.2561	20.2533	20.1665	19.7278	19.0729	18.5406	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5786	18.8755	19.2991	19.7991	20.0991	20.2301	20.2561	20.2533	20.1665	19.7278	19.0729	18.5406	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9748	0.9528	0.9077	0.8031	0.6484	0.4636	0.3226	0.3700	0.6159	0.8671	0.9564	0.9789	(94)
Useful gains	526.7446	623.9320	699.1814	735.2760	653.0563	467.6063	311.0718	325.2714	477.7963	550.6327	519.2911	500.6729	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1266.1126	1235.8813	1128.8425	949.2294	729.7646	483.7631	314.1454	330.3996	523.5033	793.0739	1045.2780	1258.2520	(97)
Space heating kWh	550.0898	411.2299	319.6679	154.0465	57.0709	0.0000	0.0000	0.0000	0.0000	180.3763	378.7105	563.6388	(98a)
Space heating requirement - total per year (kWh/year)												2614.8305	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	550.0898	411.2299	319.6679	154.0465	57.0709	0.0000	0.0000	0.0000	0.0000	180.3763	378.7105	563.6388	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2614.8305	
Space heating per m2											(98c) / (4) =	33.2000	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	807.6834	635.8358	651.6668	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9012	0.9407	0.9188	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	727.8510	598.1525	598.7359	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1136.9442	1087.1117	989.8335	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	294.5471	363.7856	290.9766	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.6368	90.9464	72.7442	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												237.3273	(107)
Energy for space heating												33.2000	(99)
Energy for space cooling												3.0133	(108)
Total												36.2133	(109)
Fabric Energy Efficiency (TFEE)												36.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800	(1b) x	2.4000	(2b) =	94.5120	(1b) - (3b)
First floor	39.3800	(1c) x	2.6000	(2c) =	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.9000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12893.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.7042 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1563 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	(38)
Heat transfer coeff	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	(39)
Average = Sum(39)m / 12 =												81.4556	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	(40)
HLP (average)												1.0342	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4389 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day)	122.1126 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)
Energy content (annual)										Total = Sum(45)m =		2028.2648	
Distribution loss (46)m = 0.15 x (45)m	31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)
										Total per year (kWh/year) = Sum(64)m =		2564.3038	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	106.3761	94.4515	101.0944	90.4588	88.8065	81.2203	80.9310	83.4068	83.5253	91.7231	95.8336	105.4018	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.7385	28.1898	22.9255	17.3561	12.9739	10.9531	11.8352	15.3838	20.6482	26.2176	30.5998	32.6206	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.6260	326.9842	318.5216	300.5057	277.7639	256.3897	242.1105	238.7523	247.2149	265.2308	287.9726	309.3468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)

Water heating gains (Table 5)

142.9786	140.5528	135.8796	125.6373	119.3636	112.8060	108.7783	112.1059	116.0074	123.2837	133.1022	141.6691	(72)

Total internal gains

599.1937	596.5775	578.1774	544.3497	510.9519	480.9994	463.5746	467.0926	484.7210	515.5827	552.5253	584.4870	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	19.6403	0.3900	0.0000	0.7700	72.1322	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	130.0503	254.4059	418.9703	611.0432	748.8564	766.5877	729.8228	626.9070	487.2798	301.8740	162.1574	106.9470	(83)
Total gains	729.2440	850.9834	997.1477	1155.3929	1259.8083	1247.5872	1193.3974	1093.9996	972.0008	817.4568	714.6827	691.4341	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	
alpha	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	
util living area	0.9581	0.9272	0.8586	0.7295	0.5660	0.4099	0.2985	0.3391	0.5479	0.8112	0.9326	0.9650	(86)
Living	19.7245	19.9930	20.3735	20.7249	20.9142	20.9808	20.9957	20.9929	20.9431	20.6452	20.1022	19.6482	
Non living	18.5943	18.9260	19.3850	19.7860	19.9827	20.0426	20.0531	20.0517	20.0145	19.7125	19.0680	18.4992	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3475	19.9930	20.3735	20.7249	20.9142	20.9808	20.9957	20.9929	20.9431	20.6452	20.1022	19.8373	(87)
Th 2	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	(88)
util rest of house	0.9501	0.9144	0.8357	0.6923	0.5170	0.3522	0.2352	0.2709	0.4822	0.7728	0.9183	0.9582	(89)
MIT 2	19.4726	18.9260	19.3850	19.7860	19.9827	20.0426	20.0531	20.0517	20.0145	19.7125	19.0680	18.7795	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	19.6970	19.1997	19.6385	20.0268	20.2216	20.2832	20.2949	20.2931	20.2527	19.9517	19.3333	19.0508	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6970	19.1997	19.6385	20.0268	20.2216	20.2832	20.2949	20.2931	20.2527	19.9517	19.3333	19.0508	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9467	0.9004	0.8244	0.6912	0.5259	0.3663	0.2514	0.2883	0.4964	0.7682	0.9050	0.9493	(94)
Useful gains	690.3471	766.2105	822.0275	798.5655	662.5327	456.9773	299.9643	315.3793	482.5000	627.9336	646.7858	656.3519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1254.1727	1164.7897	1070.2063	906.3398	694.1306	462.9311	300.9663	317.1143	501.1691	761.7480	996.4674	1209.6819	(97)
Space heating kWh	419.4863	267.8452	184.6450	77.5976	23.5089	0.0000	0.0000	0.0000	0.0000	99.5579	251.7707	411.6775	(98a)
Space heating requirement - total per year (kWh/year)												1736.0891	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	419.4863	267.8452	184.6450	77.5976	23.5089	0.0000	0.0000	0.0000	0.0000	99.5579	251.7707	411.6775	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1736.0891	
Space heating per m2											(98c) / (4) =	22.0428	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.4448	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.4863	267.8452	184.6450	77.5976	23.5089	0.0000	0.0000	0.0000	0.0000	99.5579	251.7707	411.6775	(98)
Space heating efficiency (main heating system 1)	266.4448	266.4448	266.4448	266.4448	266.4448	0.0000	0.0000	0.0000	0.0000	266.4448	266.4448	266.4448	(210)
Space heating fuel (main heating system)	157.4383	100.5256	69.2995	29.1233	8.8232	0.0000	0.0000	0.0000	0.0000	37.3653	94.4926	154.5076	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)
Efficiency of water heater												184.0555	(216)
(217)m	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	(217)
Fuel for water heating, kWh/month	139.0434	122.9238	130.4130	114.1560	110.3342	99.0600	97.4654	101.5109	102.8264	115.1000	122.9385	137.4513	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.4511	2.2139	2.4511	2.3720	2.4511	2.3720	2.4511	2.4511	2.3720	2.4511	2.3720	2.4511	(231)
Lighting	27.7805	22.2865	20.0666	14.7016	11.3560	9.2779	10.3593	13.4654	17.4902	22.9481	25.9198	28.5526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	651.5754	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.0555	
Water heating fuel used	1393.2230	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.8593	(230a)
Total electricity for the above, kWh/year	28.8593	(231)
Electricity for lighting (calculated in Appendix L)	224.2045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2297.8623	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	521.2604	17.5600	102.1670	(240)
Space heating - main system 1 (low-rate cost)	130.3151	0.0940	12.2496	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	975.2561	19.6000	191.1502	(245)
Low-rate cost	417.9669	9.4000	39.2889	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	28.8593	18.5800	4.8028	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	224.2045	18.5800	41.6572	(250)
Additional standing charges			7.0000	(251)
Total energy cost			398.3157	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1586	(257)
SAP value		81.2184	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	521.2604	0.1646	85.7980	(261)
Space heating - main system 1 (low-rate cost)	130.3151	0.1382	18.0073	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	975.2561	0.1479	144.2612	(264)
Water heating - low rate cost	417.9669	0.1241	51.8893	(264)
Space and water heating			299.9558	(265)
Pumps, fans and electric keep-hot	28.8593	0.1432	4.0044	(267)
Energy for lighting	224.2045	0.1490	33.4109	(268)
Total CO2, kg/year			337.3711	(272)
CO2 emissions per m2			4.2800	(273)
EI value			96.3471	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800	(1b)	x 2.4000	(2b) =	94.5120	(1b) - (3b)
First floor	39.3800	(1c)	x 2.6000	(2c) =	102.3880	(1c) - (3c)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 78.7600 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 196.9000 (5)

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2. Ventilation rate
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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12893.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 163.7042 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.1563 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	(38)
Heat transfer coeff	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	(39)

Average = Sum(39)m / 12 = 81.4556

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	(40)
HLP (average)												1.0342	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4389 (42)
Hot water usage for mixer showers

65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day) 122.1126 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)

Energy content (annual)											Total = Sum(45)m =	2028.2648	
Distribution loss (46)m = 0.15 x (45)m													
	31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)
											Total per year (kWh/year) = Sum(64)m =	2564.3038	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.3761	94.4515	101.0944	90.4588	88.8065	81.2203	80.9310	83.4068	83.5253	91.7231	95.8336	105.4018	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.7385	28.1898	22.9255	17.3561	12.9739	10.9531	11.8352	15.3838	20.6482	26.2176	30.5998	32.6206	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.6260	326.9842	318.5216	300.5057	277.7639	256.3897	242.1105	238.7523	247.2149	265.2308	287.9726	309.3468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)
Water heating gains (Table 5)													
	142.9786	140.5528	135.8796	125.6373	119.3636	112.8060	108.7783	112.1059	116.0074	123.2837	133.1022	141.6691	(72)
Total internal gains													
	599.1937	596.5775	578.1774	544.3497	510.9519	480.9994	463.5746	467.0926	484.7210	515.5827	552.5253	584.4870	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	26.6540	0.3900	0.0000	0.7700	97.8914	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	176.4928	291.2496	472.1654	703.3177	829.5562	907.4597	867.7967	749.3579	588.3063	368.3171	211.9771	144.7184	(83)
Total gains	775.6865	887.8270	1050.3428	1247.6674	1340.5081	1388.4591	1331.3712	1216.4505	1073.0273	883.8998	764.5024	729.2055	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	
alpha	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	
util living area													
	0.9398	0.9066	0.8179	0.6540	0.4710	0.3031	0.2016	0.2205	0.4234	0.7168	0.8933	0.9477	(86)
Living	19.9399	20.1492	20.5205	20.8299	20.9610	20.9947	20.9992	20.9989	20.9808	20.8082	20.3536	19.8983	
Non living	18.8631	19.1176	19.5567	19.8971	20.0254	20.0522	20.0547	20.0546	20.0437	19.8866	19.3733	18.8130	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4577	20.1492	20.5205	20.8299	20.9610	20.9947	20.9992	20.9989	20.9808	20.8082	20.3536	20.0524	(87)
Th 2	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	(88)
util rest of house													
	0.9283	0.8902	0.7897	0.6118	0.4198	0.2488	0.1440	0.1576	0.3567	0.6653	0.8707	0.9373	(89)
MIT 2	19.5798	19.1176	19.5567	19.8971	20.0254	20.0522	20.0547	20.0546	20.0437	19.8866	19.3733	19.0368	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	19.8050	19.3822	19.8039	20.1363	20.2653	20.2939	20.2970	20.2968	20.2840	20.1229	19.6248	19.2972	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8050	19.3822	19.8039	20.1363	20.2653	20.2939	20.2970	20.2968	20.2840	20.1229	19.6248	19.2972	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9249	0.8766	0.7815	0.6156	0.4314	0.2626	0.1588	0.1737	0.3732	0.6693	0.8588	0.9273	(94)
Useful gains	717.4209	778.2572	820.7993	768.0804	578.2812	364.6229	211.4079	211.3452	400.4031	591.5640	656.5644	676.1679	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1181.5099	1114.4905	1010.3666	833.8060	591.8032	366.0521	211.5366	211.5255	405.9783	661.6588	906.1742	1123.8626	(97)
Space heating kWh													
	345.2822	225.9488	141.0380	47.3224	10.0604	0.0000	0.0000	0.0000	0.0000	52.1505	179.7191	333.0848	(98a)
Space heating requirement - total per year (kWh/year)												1334.6063	
Solar heating kWh													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000	
Space heating kWh												
	345.2822	225.9488	141.0380	47.3224	10.0604	0.0000	0.0000	0.0000	0.0000	52.1505	179.7191	333.0848 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)											1334.6063	
Space heating per m2										(98c) / (4) =	16.9452	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	266.4448 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	345.2822	225.9488	141.0380	47.3224	10.0604	0.0000	0.0000	0.0000	0.0000	52.1505	179.7191	333.0848	(98)
Space heating efficiency (main heating system 1)													
	266.4448	266.4448	266.4448	266.4448	266.4448	0.0000	0.0000	0.0000	0.0000	266.4448	266.4448	266.4448	(210)
Space heating fuel (main heating system)													
	129.5886	84.8013	52.9333	17.7607	3.7758	0.0000	0.0000	0.0000	0.0000	19.5727	67.4508	125.0108	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	255.9170	226.2481	240.0323	210.1104	203.0762	182.3254	179.3905	186.8364	189.2577	211.8478	226.2751	252.9868	(64)
Efficiency of water heater												184.0555	(216)
(217)m	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	(217)
Fuel for water heating, kWh/month													
	139.0434	122.9238	130.4130	114.1560	110.3342	99.0600	97.4654	101.5109	102.8264	115.1000	122.9385	137.4513	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.4511	2.2139	2.4511	2.3720	2.4511	2.3720	2.4511	2.4511	2.3720	2.4511	2.3720	2.4511	(231)
Lighting	27.7805	22.2865	20.0666	14.7016	11.3560	9.2779	10.3593	13.4654	17.4902	22.9481	25.9198	28.5526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year	
Space heating fuel - main system 1	500.8940 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	184.0555
Water heating fuel used	1393.2230 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)	
mechanical ventilation fans (SFP = 0.1201)	28.8593 (230a)
Total electricity for the above, kWh/year	28.8593 (231)
Electricity for lighting (calculated in Appendix L)	224.2045 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2147.1809 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	400.7152	27.8600	125.0232	(240)
Space heating - main system 1 (low-rate cost)	100.1788	0.1450	14.5259	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	975.2561	31.2000	304.2799	(245)
Low-rate cost	417.9669	14.5000	60.6052	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	28.8593	29.5300	7.6064	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	224.2045	29.5300	66.2076	(250)
Additional standing charges			3.0000	(251)
Total energy cost			581.2482	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	

Space heating - main system 1 (high-rate cost)	400.7152	0.1656	66.3573	(261)
Space heating - main system 1 (low-rate cost)	100.1788	0.1390	13.9262	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	975.2561	0.1479	144.2612	(264)
Water heating - low rate cost	417.9669	0.1241	51.8893	(264)
Space and water heating			276.4341	(265)
Pumps, fans and electric keep-hot	28.8593	0.1432	4.0044	(267)
Energy for lighting	224.2045	0.1490	33.4109	(268)
Total CO2, kg/year			313.8494	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	400.7152	1.2936	647.9460	(275)
Space heating - main system 1 (low-rate cost)	100.1788	1.5038	150.6532	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	975.2561	1.5529	1514.5056	(278)
Water heating - low rate cost	417.9669	1.4443	603.6601	(278)
Space and water heating			2916.7649	(279)
Pumps, fans and electric keep-hot	28.8593	1.5335	43.6628	(281)
Energy for lighting	224.2045	1.5547	348.5807	(282)
Total Primary energy kWh/year			3309.0084	(286)

SAP 10 EPC IMPROVEMENTS

3B4P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating			Recommended
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 95	-46 kg (14.8%)
U Solar photovoltaic panels	+ 9.5	-£ 326	-265 kg (99.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£95	0.59 kg/m²	B 83	A 97
Solar photovoltaic panels	£326	3.36 kg/m²	A 93	A 99
Total Savings	£421	3.95 kg/m²		

Potential energy efficiency rating: A 93
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£581	£486	£95
Space heating	£150	£174	-£24
Water heating	£365	£246	£119
Lighting	£66	£66	£0
Generated (PV)	-£0	-£326	£326
Total cost of fuels	£581	£160	£421
Total cost of uses	£581	£160	£421
Delivered energy	27 kWh/m²	-3 kWh/m²	30 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	4 kg/m²
Primary energy	42 kWh/m²	12 kWh/m²	30 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800	(1b) x	2.4000	(2b) =	94.5120	(1b) - (3b)
First floor	39.3800	(1c) x	2.6000	(2c) =	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	196.9000	(5)

2. Ventilation rate

m3 per hour

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12893.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	163.7042	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1563 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	(38)
Heat transfer coeff	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	(39)
Average = Sum(39)m / 12 =												81.4556	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	(40)
HLP (average)												1.0342	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4389	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day)	122.1126 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)
Energy content (annual)										Total = Sum(45)m =		2028.2648	
Distribution loss (46)m = 0.15 x (45)m	31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)

Water storage loss:	
Store volume	210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3300 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7182 (55)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	255.9170	226.2481	238.6366	203.3568	190.2818	169.7187	166.3636	174.7400	183.8548	210.4521	226.2751	252.9868	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												612.1149	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												612.1149	
Solar input	-0.0000	-16.2223	-57.9164	-79.1701	-102.6996	-94.4488	-93.6217	-82.2619	-57.1646	-28.6095	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	255.9170	210.0258	180.7202	124.1867	87.5823	75.2699	72.7418	92.4781	126.6902	181.8426	226.2751	252.9868	(64)
									Total per year (kWh/year) = Sum(64)m =			1886.7165	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.3761	94.4515	99.9778	85.0559	78.5711	71.1349	70.5095	73.7296	79.2030	90.6065	95.8336	105.4018	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	31.7385	28.1898	22.9255	17.3561	12.9739	10.9531	11.8352	15.3838	20.6482	26.2176	30.5998	32.6206	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	323.6260	326.9842	318.5216	300.5057	277.7639	256.3897	242.1105	238.7523	247.2149	265.2308	287.9726	309.3468	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)
Water heating gains (Table 5)													
	142.9786	140.5528	134.3788	118.1333	105.6063	98.7985	94.7708	99.0990	110.0042	121.7829	133.1022	141.6691	(72)
Total internal gains													
	599.1937	596.5775	576.6766	536.8457	497.1946	466.9919	449.5671	454.0857	478.7178	514.0819	552.5253	584.4870	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	19.6403	0.3900	0.0000	0.7700	72.1322	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	130.0503	254.4059	418.9703	611.0432	748.8564	766.5877	729.8228	626.9070	487.2798	301.8740	162.1574	106.9470	(83)
Total gains	729.2440	850.9834	995.6469	1147.8889	1246.0510	1233.5797	1179.3899	1080.9927	965.9976	815.9560	714.6827	691.4341	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	
alpha	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	
util living area													
	0.9581	0.9272	0.8591	0.7325	0.5711	0.4142	0.3019	0.3431	0.5507	0.8119	0.9326	0.9650	(86)
Living	19.7245	19.9930	20.3720	20.7208	20.9115	20.9801	20.9955	20.9926	20.9421	20.6440	20.1022	19.6482	
Non living	18.5943	18.9260	19.3832	19.7817	19.9803	20.0421	20.0530	20.0515	20.0137	19.7112	19.0680	18.4992	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3475	19.9930	20.3720	20.7208	20.9115	20.9801	20.9955	20.9926	20.9421	20.6440	20.1022	19.8373	(87)
Th 2	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	(88)
util rest of house													
	0.9501	0.9144	0.8362	0.6954	0.5219	0.3560	0.2380	0.2742	0.4849	0.7736	0.9183	0.9582	(89)
MIT 2	19.4726	18.9260	19.3832	19.7817	19.9803	20.0421	20.0530	20.0515	20.0137	19.7112	19.0680	18.7795	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	19.6970	19.1997	19.6368	20.0226	20.2191	20.2827	20.2947	20.2929	20.2518	19.9504	19.3333	19.0508	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6970	19.1997	19.6368	20.0226	20.2191	20.2827	20.2947	20.2929	20.2518	19.9504	19.3333	19.0508	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9467	0.9004	0.8249	0.6940	0.5307	0.3702	0.2543	0.2917	0.4991	0.7689	0.9050	0.9493	(94)
Useful gains	690.3471	766.2105	821.2954	796.6504	661.3189	456.7043	299.9124	315.2901	482.0845	627.3683	646.7858	656.3519	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

	1254.1727	1164.7897	1070.0658	905.9960	693.9272	462.8868	300.9577	317.0996	501.1001	761.6428	996.4674	1209.6819	(97)
Space heating kWh													
	419.4863	267.8452	185.0852	78.7289	24.2606	0.0000	0.0000	0.0000	0.0000	99.9002	251.7707	411.6775	(98a)
Space heating requirement - total per year (kWh/year)												1738.7545	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	419.4863	267.8452	185.0852	78.7289	24.2606	0.0000	0.0000	0.0000	0.0000	99.9002	251.7707	411.6775	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1738.7545	
Space heating per m2											(98c) / (4) =	22.0766	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												266.4448	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	419.4863	267.8452	185.0852	78.7289	24.2606	0.0000	0.0000	0.0000	0.0000	99.9002	251.7707	411.6775	(98)
Space heating efficiency (main heating system 1)													
	266.4448	266.4448	266.4448	266.4448	266.4448	0.0000	0.0000	0.0000	0.0000	266.4448	266.4448	266.4448	(210)
Space heating fuel (main heating system)													
	157.4383	100.5256	69.4647	29.5479	9.1053	0.0000	0.0000	0.0000	0.0000	37.4938	94.4926	154.5076	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	255.9170	210.0258	180.7202	124.1867	87.5823	75.2699	72.7418	92.4781	126.6902	181.8426	226.2751	252.9868	(64)
Efficiency of water heater												184.0555	(216)
(217)m	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	(217)
Fuel for water heating, kWh/month													
	139.0434	114.1100	98.1879	67.4724	47.5847	40.8952	39.5217	50.2447	68.8326	98.7977	122.9385	137.4513	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.2456	8.3508	9.2456	8.9473	9.2456	8.9473	9.2456	9.2456	8.9473	9.2456	8.9473	9.2456	(231)
Lighting	27.7805	22.2865	20.0666	14.7016	11.3560	9.2779	10.3593	13.4654	17.4902	22.9481	25.9198	28.5526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.6948	-53.4723	-78.1486	-87.5460	-92.8481	-85.9867	-84.8145	-80.3873	-71.8750	-60.8296	-40.7205	-31.4302	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-13.3917	-30.1077	-64.1976	-103.2260	-142.8346	-145.7270	-143.8370	-119.3867	-84.5881	-46.0163	-18.6893	-10.4836	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												652.5758	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												184.0555	
Water heating fuel used												1025.0801	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												28.8593	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												108.8593	(231)
Electricity for lighting (calculated in Appendix L)												224.2045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1727.2394	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												283.4803	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	522.0607	17.5600	102.3239	(240)
Space heating - main system 1 (low-rate cost)	130.5152	0.0940	12.2684	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	717.5561	19.6000	140.6410	(245)
Low-rate cost	307.5240	9.4000	28.9073	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	28.8593	18.5800	4.8028	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	224.2045	18.5800	41.6572	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-804.7536	18.5800	-149.5232	

PV Unit electricity exported	-922.4858	5.5900	-51.5670	
Total			-201.0902	(252)
Total energy cost			151.3743	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.4403	(257)
SAP value			92.8623	
SAP rating (Section 12)			93	(258)
SAP band			A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	522.0607	0.1646	85.9160	(261)
Space heating - main system 1 (low-rate cost)	130.5152	0.1382	18.0321	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	717.5561	0.1531	109.8822	(264)
Water heating - low rate cost	307.5240	0.1285	39.5266	(264)
Space and water heating			253.3570	(265)
Pumps, fans and electric keep-hot	108.8593	0.1432	15.4607	(267)
Energy for lighting	224.2045	0.1490	33.4109	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-804.7536	0.1390	-111.8213	
PV Unit electricity exported	-922.4858	0.1241	-114.4608	
Total			-226.2822	(269)
Total CO2, kg/year			75.9464	(272)
CO2 emissions per m2			0.9600	(273)
EI value			99.1777	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.3800	(1b) x	2.4000	(2b) =	94.5120	(1b) - (3b)
First floor	39.3800	(1c) x	2.6000	(2c) =	102.3880	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.9000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			22.0500	0.6998	15.4316			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.4000	24.0100	65.3900	0.1800	11.7702	60.0000	3923.4000	(29a)
External Roof 1	39.3800		39.3800	0.0900	3.5442	9.0000	354.4200	(30)
Total net area of external elements Aum(A, m2)			168.0600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.8108			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12893.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		163.7042 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.0000	0.0980	0.9800
E12 Gable (insulation at ceiling level)	7.9100	0.0970	0.7673
P1 Party wall - Ground floor	7.9100	0.3200	2.5312
P2 Party wall - Intermediate floor within a dwelling	7.9100	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.9100	0.4800	3.7968
E1 Steel lintel with perforated steel base plate	12.5800	0.0500	0.6290
E3 Sill	11.6500	0.0450	0.5242
E4 Jamb	37.8000	0.0510	1.9278

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		11.1563 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.9671 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	32.4885	(38)
Heat transfer coeff	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	81.4556	(39)
Average = Sum(39)m / 12 =												81.4556	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	1.0342	(40)
HLP (average)												1.0342	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.4389 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.1122	64.1337	62.7078	59.9797	57.9664	55.7211	54.4449	55.8600	57.4112	59.8219	62.6087	64.8628	(42a)

Hot water usage for baths

28.1236	27.7059	27.1178	26.0333	25.2212	24.3208	23.8344	24.4185	25.0544	26.0179	27.1247	28.0285	(42b)

Hot water usage for other uses

39.6069	38.1666	36.7264	35.2861	33.8459	32.4056	32.4056	33.8459	35.2861	36.7264	38.1666	39.6069	(42c)

Average daily hot water use (litres/day)		122.1126 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.8428	130.0063	126.5520	121.2991	117.0335	112.4476	110.6850	114.1244	117.7518	122.5662	127.9001	132.4982	(44)
Energy conte	210.3904	185.1273	194.5057	166.0524	157.5496	138.2674	133.8639	141.3098	145.1997	166.3212	182.2171	207.4602	(45)
Energy content (annual)										Total = Sum(45)m =		2028.2648	

Distribution loss (46)m = 0.15 x (45)m

31.5586	27.7691	29.1759	24.9079	23.6324	20.7401	20.0796	21.1965	21.7800	24.9482	27.3326	31.1190	(46)

Water storage loss:		
Store volume		210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3300 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

255.9170	226.2481	238.6366	203.3568	190.2818	169.7187	166.3636	174.7400	183.8548	210.4521	226.2751	252.9868	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector		3.0000 (H1)
Zero-loss collector efficiency		0.8000 (H2)
Collector linear heat loss coefficient		1.8000 (H3)
Collector 2nd order heat loss coefficient		0.0000 (H4)
Collector loop efficiency		0.9000 (H5)
Incidence angle modifier		1.0000 (H6)
Overshading factor		0.8000 (H8)
Overall heat loss coefficient of system		6.5000 (H10)
Heat loss coefficient of collector loop		3.9667 (H11)
Dedicated solar storage volume		75.0000 (H12)
Effective solar volume		75.0000 (H14)
Reference volume		225.0000 (H15)
Storage tank correction coefficient		1.3161 (H16)
Heat delivered to hot water		768.6034 (H24)
Heat delivered to space heating		0.0000 (H29)
Solar input		768.6034

Solar input	-6.4574	-23.9479	-69.2791	-94.7242	-115.6162	-113.5326	-112.8464	-101.8354	-75.1778	-44.4602	-10.7264	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

249.4597	202.3002	169.3575	108.6326	74.6657	56.1861	53.5172	72.9046	108.6771	165.9919	215.5487	252.9868	(64)
								Total per year (kWh/year) = Sum(64)m =			1730.2280	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)

Heat gains from water heating, kWh/month

106.3761	94.4515	99.9778	85.0559	78.5711	71.1349	70.5095	73.7296	79.2030	90.6065	95.8336	105.4018	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	146.3347	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	31.7385	28.1898	22.9255	17.3561	12.9739	10.9531	11.8352	15.3838	20.6482	26.2176	30.5998	32.6206	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	323.6260	326.9842	318.5216	300.5057	277.7639	256.3897	242.1105	238.7523	247.2149	265.2308	287.9726	309.3468	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	52.0724	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	-97.5565	(71)

Water heating gains (Table 5)

	142.9786	140.5528	134.3788	118.1333	105.6063	98.7985	94.7708	99.0990	110.0042	121.7829	133.1022	141.6691	(72)

Total internal gains

	599.1937	596.5775	576.6766	536.8457	497.1946	466.9919	449.5671	454.0857	478.7178	514.0819	552.5253	584.4870	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2300	26.6540	0.3900	0.0000	0.7700	97.8914	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	176.4928	291.2496	472.1654	703.3177	829.5562	907.4597	867.7967	749.3579	588.3063	368.3171	211.9771	144.7184	(83)
Total gains	775.6865	887.8270	1048.8420	1240.1634	1326.7508	1374.4517	1317.3638	1203.4436	1067.0241	882.3990	764.5024	729.2055	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	43.9685	
alpha	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	3.9312	
util living area													
	0.9398	0.9066	0.8184	0.6568	0.4754	0.3061	0.2037	0.2229	0.4256	0.7176	0.8933	0.9477	(86)
Living	19.9399	20.1492	20.5192	20.8273	20.9597	20.9945	20.9992	20.9989	20.9805	20.8074	20.3536	19.8983	
Non living	18.8631	19.1176	19.5553	19.8945	20.0244	20.0521	20.0547	20.0546	20.0435	19.8858	19.3733	18.8130	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4577	20.1492	20.5192	20.8273	20.9597	20.9945	20.9992	20.9989	20.9805	20.8074	20.3536	20.0524	(87)
Th 2	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	20.0549	(88)
util rest of house													
	0.9283	0.8902	0.7902	0.6147	0.4238	0.2513	0.1455	0.1593	0.3587	0.6661	0.8707	0.9373	(89)
MIT 2	19.5798	19.1176	19.5553	19.8945	20.0244	20.0521	20.0547	20.0546	20.0435	19.8858	19.3733	19.0368	(90)
Living area fraction										fLA = Living area / (4) =		0.2565	(91)
MIT	19.8050	19.3822	19.8025	20.1337	20.2643	20.2938	20.2969	20.2968	20.2838	20.1222	19.6248	19.2972	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8050	19.3822	19.8025	20.1337	20.2643	20.2938	20.2969	20.2968	20.2838	20.1222	19.6248	19.2972	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9249	0.8766	0.7820	0.6183	0.4355	0.2652	0.1605	0.1756	0.3751	0.6700	0.8588	0.9273	(94)
Useful gains	717.4209	778.2572	820.1972	766.8533	577.7448	364.5600	211.4016	211.3363	400.2778	591.2272	656.5644	676.1679	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1181.5099	1114.4905	1010.2535	833.5932	591.7155	366.0418	211.5355	211.5239	405.9578	661.5991	906.1742	1123.8626	(97)
Space heating kWh													
	345.2822	225.9488	141.4018	48.0527	10.3942	0.0000	0.0000	0.0000	0.0000	52.3567	179.7191	333.0848	(98a)
Space heating requirement - total per year (kWh/year)												1336.2404	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	345.2822	225.9488	141.4018	48.0527	10.3942	0.0000	0.0000	0.0000	0.0000	52.3567	179.7191	333.0848	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1336.2404	
Space heating per m2											(98c) / (4) =	16.9660	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	266.4448	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	345.2822	225.9488	141.4018	48.0527	10.3942	0.0000	0.0000	0.0000	0.0000	52.3567	179.7191	333.0848	(98)
Space heating efficiency (main heating system 1)													
	266.4448	266.4448	266.4448	266.4448	266.4448	0.0000	0.0000	0.0000	0.0000	266.4448	266.4448	266.4448	(210)
Space heating fuel (main heating system)													
	129.5886	84.8013	53.0698	18.0348	3.9011	0.0000	0.0000	0.0000	0.0000	19.6501	67.4508	125.0108	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating

Water heating requirement													
	249.4597	202.3002	169.3575	108.6326	74.6657	56.1861	53.5172	72.9046	108.6771	165.9919	215.5487	252.9868	(64)
Efficiency of water heater												184.0555	(216)
(217)m	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	184.0555	(217)
Fuel for water heating, kWh/month													
	135.5350	109.9126	92.0144	59.0216	40.5669	30.5267	29.0766	39.6101	59.0458	90.1858	117.1107	137.4513	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.2456	8.3508	9.2456	8.9473	9.2456	8.9473	9.2456	9.2456	8.9473	9.2456	8.9473	9.2456	(231)
Lighting	27.7805	22.2865	20.0666	14.7016	11.3560	9.2779	10.3593	13.4654	17.4902	22.9481	25.9198	28.5526	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.0888	-57.9815	-82.8422	-92.7160	-96.0197	-91.4342	-90.3038	-86.4646	-78.8028	-67.7803	-48.9314	-39.5492	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.5810	-36.0402	-75.4180	-125.0091	-163.7888	-181.9100	-180.4713	-150.7019	-107.9342	-60.4862	-27.2749	-16.0609	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	501.5073	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	184.0555	
Water heating fuel used	940.0577	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.8593	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	108.8593	(231)
Electricity for lighting (calculated in Appendix L)	224.2045	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2024.5910	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	-249.9621	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	401.2059	27.8600	125.1762	(240)
Space heating - main system 1 (low-rate cost)	100.3015	0.1450	14.5437	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	658.0404	31.2000	205.3086	(245)
Low-rate cost	282.0173	14.5000	40.8925	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	28.8593	29.5300	7.6064	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	224.2045	29.5300	66.2076	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.9145	29.5300	-259.5434	
PV Unit electricity exported	-1145.6765	5.8100	-66.5638	
Total			-326.1072	(252)
Total energy cost			160.2518	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	401.2059	0.1656	66.4305	(261)
Space heating - main system 1 (low-rate cost)	100.3015	0.1390	13.9416	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	658.0404	0.1545	101.6831	(264)
Water heating - low rate cost	282.0173	0.1297	36.5786	(264)
Space and water heating			218.6338	(265)
Pumps, fans and electric keep-hot	108.8593	0.1432	15.4607	(267)
Energy for lighting	224.2045	0.1490	33.4109	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.9145	0.1395	-122.5849	
PV Unit electricity exported	-1145.6765	0.1241	-142.2292	
Total			-264.8141	(269)
Total CO2, kg/year			2.6913	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	401.2059	1.2935	648.7105	(275)
Space heating - main system 1 (low-rate cost)	100.3015	1.5038	150.8309	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	658.0404	1.5769	1037.6384	(278)

Water heating - low rate cost	282.0173	1.4666	413.5981	(278)
Space and water heating			2250.7779	(279)
Pumps, fans and electric keep-hot	108.8593	1.5335	166.3416	(281)
Energy for lighting	224.2045	1.5547	348.5807	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.9145	1.5199	-1335.8362	
PV Unit electricity exported	-1145.6765	0.4555	-521.8723	
Total			-1857.7086	(283)
Total Primary energy kWh/year			907.9917	(286)

Full SAP Calculation Printout

Property Reference	HT11 Havant	**Issued on Date**	22/06/2025
Assessment Reference	3B5P ASHP	**Prop Type Ref**	3B5P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.36	**TER**	11.46
Environmental	96 A	**% DER < TER**			61.95
CO_2 Emissions (t/year)	0.34	**DFEE**	34.77	**TFEE**	38.77
Compliance Check	See BREL	**% DFEE < TFEE**			10.32
% DPER < TPER	23.48	**DPER**	45.74	**TPER**	59.78

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200 (1b)	x	2.4000 (2b)	=	103.0080	(1b) - (3b)
First floor	42.9200 (1c)	x	2.6000 (2c)	=	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised		
If mechanical ventilation		0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000	(23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13335.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.3511	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12 Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1 Party wall - Ground floor	8.0300	0.3200	2.5696
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380
E5 Ground floor (normal)	18.7100	0.0670	1.2536
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7693 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 52.8901 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	(38)
Heat transfer coeff	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	(39)

Average = Sum(39)m / 12 = 88.2991

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	(40)
HLP (average)												1.0286	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5644 (42)

Hot water usage for mixer showers

67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)

Hot water usage for baths

29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)

Hot water usage for other uses

40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)

Average daily hot water use (litres/day) 126.0595 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)

Energy content (annual) Total = Sum(45)m = 2093.8220

Distribution loss (46)m = 0.15 x (45)m

32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(64)

Total per year (kWh/year) = Sum(64)m = 2629.8610 (64)

12Total per year (kWh/year) 2630 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

108.6372	96.4410	103.1847	92.2434	90.4996	82.7062	82.3696	84.9255	85.0858	93.5106	97.7919	107.6314	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.6350	129.1316	116.6350	120.5229	116.6350	120.5229	116.6350	116.6350	120.5229	116.6350	120.5229	116.6350	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.2130	233.6123	227.5662	214.6948	198.4470	183.1764	172.9746	170.5754	176.6214	189.4928	205.7406	221.0113	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)	146.0178	143.5134	138.6892	128.1158	121.6393	114.8697	110.7119	114.1471	118.1747	125.6863	135.8221	144.6659	(72)
Total internal gains	555.3317	567.7232	544.3563	524.7994	498.1873	480.0349	461.7875	462.8234	476.7850	493.2800	523.5515	543.7781	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)

East			7.5200		19.6403		0.3900		0.0000		0.7700		44.3527 (76)
West			9.8200		19.6403		0.3900		0.0000		0.7700		57.9181 (80)
Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	671.6846	794.6982	919.5615	1078.7733	1186.0316	1188.8018	1134.6121	1034.2810	914.9605	762.7068	668.4432	639.6201	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	
alpha	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	
util living area	0.9718	0.9484	0.8992	0.7877	0.6287	0.4601	0.3386	0.3858	0.6105	0.8580	0.9521	0.9763	(86)
Living	19.4876	19.7708	20.1655	20.5976	20.8611	20.9667	20.9919	20.9868	20.9067	20.5143	19.9125	19.4192	
Non living	18.3064	18.6605	19.1462	19.6541	19.9383	20.0373	20.0559	20.0532	19.9900	19.5746	18.8436	18.2202	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2263	19.7708	20.1655	20.5976	20.8611	20.9667	20.9919	20.9868	20.9067	20.5143	19.9125	19.6404	(87)
Th 2	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	(88)
util rest of house	0.9664	0.9389	0.8814	0.7543	0.5791	0.3976	0.2679	0.3098	0.5429	0.8259	0.9416	0.9716	(89)
MIT 2	19.3606	18.6605	19.1462	19.6541	19.9383	20.0373	20.0559	20.0532	19.9900	19.5746	18.8436	18.5516	(90)
Living area fraction										fLA = Living area / (4) =		0.2308	(91)
MIT	19.5604	18.9167	19.3814	19.8718	20.1513	20.2517	20.2719	20.2686	20.2016	19.7915	19.0902	18.8029	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5604	18.9167	19.3814	19.8718	20.1513	20.2517	20.2719	20.2686	20.2016	19.7915	19.0902	18.8029	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9630	0.9244	0.8664	0.7470	0.5841	0.4106	0.2840	0.3270	0.5536	0.8154	0.9277	0.9636	(94)
Useful gains	646.8440	734.6215	796.6772	805.8548	692.8006	488.1473	322.2302	338.1704	506.5663	621.8914	620.1308	616.3066	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1347.4796	1237.6653	1137.4159	968.8039	746.2394	499.0433	324.2270	341.5968	538.7623	811.5975	1058.7282	1289.4227	(97)
Space heating kWh	521.2729	338.0455	253.5096	117.3233	39.7585	0.0000	0.0000	0.0000	0.0000	141.1413	315.7901	500.7983	(98a)
Space heating requirement - total per year (kWh/year)												2227.6396	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	521.2729	338.0455	253.5096	117.3233	39.7585	0.0000	0.0000	0.0000	0.0000	141.1413	315.7901	500.7983	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2227.6396	
Space heating per m2											(98c) / (4) =	25.9511	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												263.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	521.2729	338.0455	253.5096	117.3233	39.7585	0.0000	0.0000	0.0000	0.0000	141.1413	315.7901	500.7983	(98)
Space heating efficiency (main heating system 1)	263.8000	263.8000	263.8000	263.8000	263.8000	0.0000	0.0000	0.0000	0.0000	263.8000	263.8000	263.8000	(210)
Space heating fuel (main heating system)	197.6015	128.1446	96.0992	44.4743	15.0715	0.0000	0.0000	0.0000	0.0000	53.5031	119.7081	189.8401	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(64)
Efficiency of water heater												183.5390	(216)
(217)m	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	(217)
Fuel for water heating, kWh/month	143.1398	126.5299	134.2053	117.4015	113.4191	101.7736	100.0971	104.2851	105.6729	118.3529	126.4935	141.4917	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.6714	2.4129	2.6714	2.5852	2.6714	2.5852	2.6714	2.6714	2.5852	2.6714	2.5852	2.6714	(231)
Lighting	28.5874	22.9339	20.6494	15.1286	11.6858	9.5474	10.6602	13.8565	17.9982	23.6147	26.6727	29.3819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												844.4424	(211)

Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5390	
Water heating fuel used	1432.8625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	31.4536	(230a)
Total electricity for the above, kWh/year	31.4536	(231)
Electricity for lighting (calculated in Appendix L)	230.7168	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2539.4752	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	675.5540	0.1641	110.8549	(261)
Space heating - main system 1 (low-rate cost)	168.8885	0.1378	23.2659	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1003.0037	0.1479	148.3814	(264)
Water heating - low rate cost	429.8587	0.1242	53.3713	(264)
Space and water heating			335.8735	(265)
Pumps, fans and electric keep-hot	31.4536	0.1432	4.3644	(267)
Energy for lighting	230.7168	0.1490	34.3814	(268)
Total CO2, kg/year			374.6192	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.3600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	675.5540	1.2893	1088.7191	(275)
Space heating - main system 1 (low-rate cost)	168.8885	1.4989	253.1393	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1003.0037	1.5530	1557.6528	(278)
Water heating - low rate cost	429.8587	1.4443	620.8580	(278)
Space and water heating			3520.3692	(279)
Pumps, fans and electric keep-hot	31.4536	1.5335	47.5878	(281)
Energy for lighting	230.7168	1.5547	358.7056	(282)
Total Primary energy kWh/year			3926.6626	(286)
Dwelling Primary energy Rate (DPER)			45.7400	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200	(1b) x	2.4000	(2b) =	103.0080	(1b) - (3b)
First floor	42.9200	(1c) x	2.6000	(2c) =	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 85.8400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1398	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3898	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3313	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4224	0.4142	0.4059	0.3645	0.3562	0.3148	0.3148	0.3065	0.3313	0.3562	0.3727	0.3893	(22b)
Effective ac	0.5892	0.5858	0.5824	0.5664	0.5634	0.5495	0.5495	0.5470	0.5549	0.5634	0.5695	0.5758	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.4900	1.1450	22.3168			(27)
Heatloss Floor 1			42.9200	0.1300	5.5796			(28a)
External Wall 1	93.5500	21.4500	72.1000	0.1800	12.9780			(29a)
External Roof 1	42.9200		42.9200	0.1100	4.7212			(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.5556			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.3511 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.7200	0.0600	0.6432
E12 Gable (insulation at ceiling level)	8.0300	0.0600	0.4818
P1 Party wall - Ground floor	8.0300	0.0800	0.6424
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.1200	0.9636
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0500	0.5725
E4 Jamb	38.0000	0.0500	1.9000
E5 Ground floor (normal)	18.7100	0.1600	2.9936
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3161 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 57.8717 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.7279	41.4826	41.2421	40.1124	39.9010	38.9171	38.9171	38.7349	39.2961	39.9010	40.3286	40.7756	(38)
Heat transfer coeff	99.5996	99.3543	99.1137	97.9841	97.7727	96.7888	96.7888	96.6066	97.1678	97.7727	98.2003	98.6473	(39)

Average = Sum(39)m / 12 = 97.9831

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1574	1.1546	1.1415	1.1390	1.1275	1.1275	1.1254	1.1320	1.1390	1.1440	1.1492	(40)
HLP (average)												1.1415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5644 (42)

Hot water usage for mixer showers

67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)

Hot water usage for baths

29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)

Hot water usage for other uses

40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)

Average daily hot water use (litres/day) 126.0595 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)
Energy content (annual)										Total = Sum(45)m =		2093.8220	
Distribution loss (46)m = 0.15 x (45)m	32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss

Combi loss

Total heat required for water heating calculated for each month

268.9374	237.8497	252.5389	221.4968	214.3883	192.8136	189.9372	197.6238	199.9703	223.4438	238.1842	265.9124	(62)
-30.7284	-27.1765	-28.4576	-23.5641	-21.9609	-18.7921	-17.6146	-18.7313	-19.4430	-22.9211	-25.9669	-30.1594	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS

PV diverter

Solar input

FGHRS

Output from w/h

238.2089	210.6733	224.0813	197.9327	192.4274	174.0216	172.3226	178.8925	180.5273	200.5226	212.2173	235.7530	(64)
									Total per year (kWh/year) = Sum(64)m =		2417.5805	(64)

12Total per year (kWh/year) 2418 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

113.6132	100.9355	108.1607	97.0588	95.4756	87.5217	87.3456	89.9015	89.9013	98.4866	102.6074	112.6074	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(66)m	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	116.5968	129.0893	116.5968	120.4833	116.5968	120.4833	116.5968	116.5968	120.4833	116.5968	120.4833	116.5968	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	231.2130	233.6123	227.5662	214.6948	198.4470	183.1764	172.9746	170.5754	176.6214	189.4928	205.7406	221.0113	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)													
	152.7059	150.2016	145.3773	134.8039	128.3275	121.5579	117.4000	120.8353	124.8629	132.3744	142.5103	151.3540	(72)
Total internal gains													
	564.9816	577.3691	554.0062	534.4480	507.8372	486.6835	468.4374	469.4734	483.4336	502.9300	533.2002	553.4280	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9500	10.6334	0.6300	0.7000	0.7700	12.8363	(74)
East	6.7400	19.6403	0.6300	0.7000	0.7700	40.4556	(76)
West	8.8000	19.6403	0.6300	0.7000	0.7700	52.8204	(80)

Solar gains	106.1124	206.9986	342.1823	505.2141	627.2975	646.3764	613.5988	521.1575	399.6097	245.7142	132.1395	87.4067	(83)
Total gains	671.0940	784.3677	896.1886	1039.6621	1135.1347	1133.0599	1082.0362	990.6308	883.0433	748.6441	665.3397	640.8347	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.1915	37.2834	37.3738	37.8047	37.8865	38.2716	38.2716	38.3438	38.1223	37.8865	37.7215	37.5506	
alpha	3.4794	3.4856	3.4916	3.5203	3.5258	3.5514	3.5514	3.5563	3.5415	3.5258	3.5148	3.5034	
util living area													
	0.9742	0.9557	0.9178	0.8269	0.6860	0.5157	0.3848	0.4339	0.6627	0.8805	0.9573	0.9777	(86)
MIT	19.2056	19.4880	19.9059	20.4178	20.7666	20.9370	20.9829	20.9739	20.8473	20.3608	19.7005	19.1627	(87)
Th 2	19.9519	19.9542	19.9565	19.9671	19.9691	19.9784	19.9784	19.9801	19.9748	19.9691	19.9651	19.9609	(88)
util rest of house													
	0.9690	0.9469	0.9017	0.7949	0.6333	0.4433	0.2992	0.3437	0.5899	0.8502	0.9474	0.9732	(89)
MIT 2	17.8794	18.2356	18.7558	19.3758	19.7636	19.9363	19.9709	19.9677	19.8601	19.3280	18.5152	17.8310	(90)
Living area fraction									fLA = Living area / (4) =			0.2308	(91)
MIT	18.1855	18.5246	19.0212	19.6163	19.9950	20.1672	20.2044	20.1999	20.0879	19.5663	18.7887	18.1383	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1855	18.5246	19.0212	19.6163	19.9950	20.1672	20.2044	20.1999	20.0879	19.5663	18.7887	18.1383	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9567	0.9313	0.8839	0.7826	0.6347	0.4571	0.3185	0.3637	0.5985	0.8361	0.9324	0.9620	(94)
Useful gains	642.0482	730.4680	792.1788	813.6624	720.4817	517.9632	344.5989	360.2563	528.5238	625.9052	620.3682	616.4637	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1382.9885	1353.6647	1241.0209	1050.0241	811.0282	538.8463	348.8679	367.0997	581.8319	876.6595	1147.8333	1374.9777	(97)
Space heating kWh	551.2596	418.7882	333.9385	170.1804	67.3666	0.0000	0.0000	0.0000	0.0000	186.5612	379.7749	564.3344	(98a)
Space heating requirement - total per year (kWh/year)												2672.2037	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	551.2596	418.7882	333.9385	170.1804	67.3666	0.0000	0.0000	0.0000	0.0000	186.5612	379.7749	564.3344	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2672.2037	
Space heating per m2											(98c) / (4) =	31.1301	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												92.3000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	551.2596	418.7882	333.9385	170.1804	67.3666	0.0000	0.0000	0.0000	0.0000	186.5612	379.7749	564.3344	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	597.2476	453.7250	361.7969	184.3775	72.9865	0.0000	0.0000	0.0000	0.0000	202.1248	411.4570	611.4132	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.2089	210.6733	224.0813	197.9327	192.4274	174.0216	172.3226	178.8925	180.5273	200.5226	212.2173	235.7530	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.8776	85.5700	84.9526	83.7229	81.9538	79.8000	79.8000	79.8000	79.8000	83.8983	85.3493	85.9439	(217)
Fuel for water heating, kWh/month	277.3820	246.1999	263.7723	236.4142	234.7997	218.0721	215.9431	224.1761	226.2247	239.0069	248.6455	274.3104	(219)
Space cooling fuel requirement													

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	24.2265	19.4354	17.4994	12.8208	9.9032	8.0910	9.0340	11.7427	15.2527	20.0123	22.6039	24.8998	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-39.7758	-55.8862	-80.0660	-89.7172	-96.4816	-89.9481	-88.8100	-83.9466	-75.3558	-63.7271	-43.6502	-34.4087	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-23.0675	-48.4543	-96.1803	-144.2839	-190.6251	-191.4926	-189.2638	-160.3446	-117.6376	-69.2681	-30.7884	-18.2490	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2895.1286	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2904.9469	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	195.5218	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2121.4285	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3960.1688	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2895.1286	0.2100	607.9770	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2904.9469	0.2100	610.0389	(264)
Space and water heating			1218.0159	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	195.5218	0.1443	28.2198	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-841.7734	0.1347	-113.3543	
PV Unit electricity exported	-1279.6551	0.1259	-161.1451	
Total			-274.4994	(269)
Total CO2, kg/year			983.6656	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.4600	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2895.1286	1.1300	3271.4953	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2904.9469	1.1300	3282.5900	(278)
Space and water heating			6554.0854	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	195.5218	1.5338	299.8979	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-841.7734	1.4977	-1260.7152	
PV Unit electricity exported	-1279.6551	0.4622	-591.5151	
Total			-1852.2303	(283)
Total Primary energy kWh/year			5131.8538	(286)
Target Primary Energy Rate (TPER)			59.7800	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200	(1b) x	2.4000	(2b) =	103.0080	(1b) - (3b)
First floor	42.9200	(1c) x	2.6000	(2c) =	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.6000	(5)

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2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1398	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3398	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2888	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3683	0.3610	0.3538	0.3177	0.3105	0.2744	0.2744	0.2672	0.2888	0.3105	0.3249	0.3394	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5678	0.5652	0.5626	0.5505	0.5482	0.5376	0.5376	0.5357	0.5417	0.5482	0.5528	0.5576	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13335.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.3511	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12 Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1 Party wall - Ground floor	8.0300	0.3200	2.5696
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380
E5 Ground floor (normal)	18.7100	0.0670	1.2536
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7693	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 52.8901	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	40.2108	40.0244	39.8416	38.9831	38.8225	38.0748	38.0748	37.9364	38.3628	38.8225	39.1474	39.4871	(38)
Heat transfer coeff	93.1009	92.9145	92.7317	91.8732	91.7126	90.9649	90.9649	90.8265	91.2529	91.7126	92.0375	92.3772	(39)
Average = Sum(39)m / 12 =												91.8725	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0846	1.0824	1.0803	1.0703	1.0684	1.0597	1.0597	1.0581	1.0631	1.0684	1.0722	1.0762	(40)
HLP (average)												1.0703	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5644	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)
Hot water usage for other uses	40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)
Average daily hot water use (litres/day)												64.0884	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	69.9204	68.0023	65.9082	63.3018	60.9767	58.5603	58.0583	60.1481	62.2915	64.7729	67.4024	69.8222	(44)
Energy conte	110.7368	96.8343	101.2984	86.6570	82.0863	72.0067	70.2164	74.4759	76.8116	87.8963	96.0270	109.3247	(45)
Energy content (annual)										Total = Sum(45)m =		1064.3716	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	94.1262	82.3092	86.1037	73.6585	69.7734	61.2057	59.6840	63.3045	65.2899	74.7118	81.6230	92.9260 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)

Output from w/h

	94.1262	82.3092	86.1037	73.6585	69.7734	61.2057	59.6840	63.3045	65.2899	74.7118	81.6230	92.9260 (64)

Total per year (kWh/year) = Sum(64)m = 904.7158 (64)

12Total per year (kWh/year) 905 (64)

Electric shower(s)

	53.8290	47.9621	52.3727	49.9787	50.9165	48.5694	50.1884	50.9165	49.9787	52.3727	51.3879	53.8290 (64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 612.3015 (64a)

Heat gains from water heating, kWh/month

	36.9888	32.5678	34.6191	30.9093	30.1725	27.4438	27.4681	28.5553	28.8171	31.7711	33.2527	36.6887 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	116.6350	129.1316	116.6350	120.5229	116.6350	120.5229	116.6350	116.6350	120.5229	116.6350	120.5229	116.6350	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	231.2130	233.6123	227.5662	214.6948	198.4470	183.1764	172.9746	170.5754	176.6214	189.4928	205.7406	221.0113	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)

Water heating gains (Table 5)

	49.7161	48.4640	46.5310	42.9296	40.5544	38.1164	36.9195	38.3807	40.0238	42.7031	46.1843	49.3128	(72)

Total internal gains

	459.0301	472.6738	452.1982	439.6132	417.1023	403.2815	387.9950	387.0570	398.6340	410.2969	433.9137	448.4251	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	575.3830	699.6488	827.4034	993.5871	1104.9467	1112.0484	1060.8196	958.5146	836.8095	679.7237	578.8055	544.2671	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7876	39.8674	39.9460	40.3193	40.3899	40.7219	40.7219	40.7839	40.5933	40.3899	40.2473	40.0993	
alpha	3.6525	3.6578	3.6631	3.6880	3.6927	3.7148	3.7148	3.7189	3.7062	3.6927	3.6832	3.6733	
util living area	0.9831	0.9660	0.9275	0.8285	0.6757	0.4999	0.3709	0.4244	0.6645	0.8967	0.9698	0.9861	(86)
MIT	19.2067	19.5123	19.9524	20.4750	20.8064	20.9520	20.9877	20.9800	20.8658	20.3731	19.6939	19.1552	(87)
Th 2	20.0134	20.0152	20.0170	20.0252	20.0267	20.0339	20.0339	20.0352	20.0311	20.0267	20.0236	20.0204	(88)
util rest of house	0.9797	0.9592	0.9133	0.7977	0.6249	0.4321	0.2922	0.3401	0.5946	0.8700	0.9626	0.9832	(89)
MIT 2	18.3831	18.6849	19.1134	19.6074	19.8934	20.0087	20.0296	20.0276	19.9515	19.5293	18.8734	18.3371	(90)

Living area fraction fLA = Living area / (4) = 0.2308 (91)

MIT	18.5731	18.8758	19.3070	19.8076	20.1041	20.2264	20.2507	20.2474	20.1625	19.7240	19.0628	18.5259	(92)

Temperature adjustment 0.0000

adjusted MIT	18.5731	18.8758	19.3070	19.8076	20.1041	20.2264	20.2507	20.2474	20.1625	19.7240	19.0628	18.5259	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9728	0.9491	0.9009	0.7900	0.6291	0.4460	0.3102	0.3591	0.6047	0.8602	0.9533	0.9771	(94)
Useful gains	559.7252	664.0503	745.4246	784.9710	695.1601	495.9289	329.0211	344.1944	506.0520	584.6811	551.7698	531.8166	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1328.8427	1298.5585	1187.6157	1002.1191	770.7602	511.8027	332.0851	349.4483	553.2234	836.7866	1101.0236	1323.3885	(97)
Space heating kWh	572.2235	426.3895	328.9901	156.3466	56.2465	0.0000	0.0000	0.0000	0.0000	187.5665	395.4627	588.9294	(98a)

Space heating requirement - total per year (kWh/year) 2712.1549

Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh	572.2235	426.3895	328.9901	156.3466	56.2465	0.0000	0.0000	0.0000	0.0000	187.5665	395.4627	588.9294	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2712.1549

Space heating per m2 (98c) / (4) = 31.5955 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	855.0704	673.1405	690.2812	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9083	0.9447	0.9222	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	776.6329	635.9374	636.5857	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1254.3866	1196.7746	1079.4801	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	343.9826	417.2628	329.5135	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	85.9957	104.3157	82.3784	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												272.6897	(107)
Energy for space heating												31.5955	(99)
Energy for space cooling												3.1767	(108)
Total												34.7722	(109)
Fabric Energy Efficiency (DFEE)												34.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200	(1b)	x 2.4000	(2b) =	103.0080	(1b) - (3b)
First floor	42.9200	(1c)	x 2.6000	(2c) =	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.6000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1398	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3898	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3313	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4224	0.4142	0.4059	0.3645	0.3562	0.3148	0.3148	0.3065	0.3313	0.3562	0.3727	0.3893	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5892	0.5858	0.5824	0.5664	0.5634	0.5495	0.5495	0.5470	0.5549	0.5634	0.5695	0.5758	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.4900	1.1450	22.3168			(27)
Heatloss Floor 1			42.9200	0.1300	5.5796			(28a)
External Wall 1	93.5500	21.4500	72.1000	0.1800	12.9780			(29a)
External Roof 1	42.9200		42.9200	0.1100	4.7212			(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.5556			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.3511 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.7200	0.0600	0.6432
E12 Gable (insulation at ceiling level)	8.0300	0.0600	0.4818
P1 Party wall - Ground floor	8.0300	0.0800	0.6424
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.1200	0.9636
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0500	0.5725
E4 Jamb	38.0000	0.0500	1.9000

E5 Ground floor (normal)	18.7100	0.1600	2.9936	
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000	
E16 Corner (normal)	10.0000	0.0900	0.9000	
E18 Party wall between dwellings	10.0000	0.0600	0.6000	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.3161 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 57.8717 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	41.7279	41.4826	41.2421	40.1124	39.9010	38.9171	38.9171	38.7349	39.2961	39.9010	40.3286	40.7756	(38)
Heat transfer coeff	99.5996	99.3543	99.1137	97.9841	97.7727	96.7888	96.7888	96.6066	97.1678	97.7727	98.2003	98.6473	(39)

Average = Sum(39)m / 12 = 97.9831

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1603	1.1574	1.1546	1.1415	1.1390	1.1275	1.1275	1.1254	1.1320	1.1390	1.1440	1.1492	(40)
HLP (average)												1.1415	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.5644 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)
Hot water usage for other uses	40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)

Average daily hot water use (litres/day) 64.0884 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	69.9204	68.0023	65.9082	63.3018	60.9767	58.5603	58.0583	60.1481	62.2915	64.7729	67.4024	69.8222	(44)
Energy conte	110.7368	96.8343	101.2984	86.6570	82.0863	72.0067	70.2164	74.4759	76.8116	87.8963	96.0270	109.3247	(45)

Energy content (annual) Total = Sum(45)m = 1064.3716

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	94.1262	82.3092	86.1037	73.6585	69.7734	61.2057	59.6840	63.3045	65.2899	74.7118	81.6230	92.9260	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	94.1262	82.3092	86.1037	73.6585	69.7734	61.2057	59.6840	63.3045	65.2899	74.7118	81.6230	92.9260	(64)

Total per year (kWh/year) = Sum(64)m = 904.7158 (64)

12Total per year (kWh/year) 905 (64)

Electric shower(s)	53.8290	47.9621	52.3727	49.9787	50.9165	48.5694	50.1884	50.9165	49.9787	52.3727	51.3879	53.8290	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 612.3015 (64a)

Heat gains from water heating, kWh/month	36.9888	32.5678	34.6191	30.9093	30.1725	27.4438	27.4681	28.5553	28.8171	31.7711	33.2527	36.6887	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	128.2197	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	116.5968	129.0893	116.5968	120.4833	116.5968	120.4833	116.5968	116.5968	120.4833	116.5968	120.4833	116.5968	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	231.2130	233.6123	227.5662	214.6948	198.4470	183.1764	172.9746	170.5754	176.6214	189.4928	205.7406	221.0113	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	35.8220	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)	49.7161	48.4640	46.5310	42.9296	40.5544	38.1164	36.9195	38.3807	40.0238	42.7031	46.1843	49.3128	(72)
Total internal gains	458.9918	472.6315	452.1599	439.5736	417.0641	403.2420	387.9568	387.0188	398.5945	410.2587	433.8742	448.3868	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.9500	10.6334	0.6300	0.7000	0.7700	12.8363	(74)
East	6.7400	19.6403	0.6300	0.7000	0.7700	40.4556	(76)
West	8.8000	19.6403	0.6300	0.7000	0.7700	52.8204	(80)

Solar gains	106.1124	206.9986	342.1823	505.2141	627.2975	646.3764	613.5988	521.1575	399.6097	245.7142	132.1395	87.4067	(83)
Total gains	565.1042	679.6301	794.3423	944.7877	1044.3616	1049.6184	1001.5556	908.1763	798.2042	655.9728	566.0138	535.7935	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.1915	37.2834	37.3738	37.8047	37.8865	38.2716	38.2716	38.3438	38.1223	37.8865	37.7215	37.5506	
alpha	3.4794	3.4856	3.4916	3.5203	3.5258	3.5514	3.5514	3.5563	3.5415	3.5258	3.5148	3.5034	
util living area													
	0.9844	0.9703	0.9393	0.8577	0.7223	0.5493	0.4132	0.4689	0.7075	0.9123	0.9730	0.9870	(86)
MIT	19.0324	19.3276	19.7700	20.3297	20.7230	20.9231	20.9785	20.9667	20.8106	20.2522	19.5465	18.9884	(87)
Th 2	19.9519	19.9542	19.9565	19.9671	19.9691	19.9784	19.9784	19.9801	19.9748	19.9691	19.9651	19.9609	(88)
util rest of house													
	0.9811	0.9641	0.9266	0.8291	0.6708	0.4744	0.3223	0.3731	0.6357	0.8878	0.9663	0.9842	(89)
MIT 2	18.1665	18.4592	18.8926	19.4293	19.7762	19.9377	19.9709	19.9676	19.8612	19.3727	18.6862	18.1294	(90)
Living area fraction										fLA = Living area / (4) =		0.2308	(91)
MIT	18.3663	18.6596	19.0951	19.6371	19.9947	20.1651	20.2035	20.1981	20.0803	19.5757	18.8848	18.3276	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3663	18.6596	19.0951	19.6371	19.9947	20.1651	20.2035	20.1981	20.0803	19.5757	18.8848	18.3276	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9742	0.9540	0.9136	0.8186	0.6722	0.4886	0.3428	0.3943	0.6437	0.8764	0.9569	0.9781	(94)
Useful gains	550.5371	648.3619	725.7372	773.4336	701.9996	512.8755	343.3651	358.0712	513.8337	574.8867	541.6355	524.0522	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1400.9992	1367.0724	1248.3442	1052.0619	810.9953	538.6433	348.7751	366.9252	581.0946	877.5749	1157.2683	1393.6503	(97)
Space heating kWh													
	632.7438	482.9734	388.8196	200.6124	81.0928	0.0000	0.0000	0.0000	0.0000	225.2000	443.2557	646.9809	(98a)
Space heating requirement - total per year (kWh/year)												3101.6787	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	632.7438	482.9734	388.8196	200.6124	81.0928	0.0000	0.0000	0.0000	0.0000	225.2000	443.2557	646.9809	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3101.6787	
Space heating per m2											(98c) / (4) =	36.1333	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	909.8146	716.2370	734.2100	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8693	0.9166	0.8881	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.8926	656.5262	652.0334	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1181.4592	1127.5460	1020.6832	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	281.2080	350.4387	274.2754	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	70.3020	87.6097	68.5688	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												226.4805	(107)
Energy for space heating												36.1333	(99)
Energy for space cooling												2.6384	(108)
Total												38.7717	(109)
Fabric Energy Efficiency (TFEE)												38.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling							
Ground floor		42.9200	(1b) x	2.4000	(2b) =	103.0080	(1b) - (3b)
First floor		42.9200	(1c) x	2.6000	(2c) =	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		214.6000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)

Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor								(20) = 1 - [0.075 x (19)] =				0.8500	(20)
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =				0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 13335.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.3511	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E10	Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12	Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1	Party wall - Ground floor	8.0300	0.3200	2.5696
P2	Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2	Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3	Sill	11.4500	0.0450	0.5152
E4	Jamb	38.0000	0.0510	1.9380
E5	Ground floor (normal)	18.7100	0.0670	1.2536
E6	Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16	Corner (normal)	10.0000	0.0570	0.5700
E18	Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	13.7693	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 52.8901	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	(38)
Heat transfer coeff	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	(39)
Average = Sum(39)m / 12 =												88.2991	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	(40)
HLP (average)												1.0286	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5644	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)
Hot water usage for baths	29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)
Hot water usage for other uses	40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)
Average daily hot water use (litres/day)												126.0595	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)
Energy content (annual)										Total = Sum(45)m =		2093.8220	
Distribution loss (46)m = 0.15 x (45)m	32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)

Water storage loss:		
Store volume	210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3300	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7182	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(64)

											Total per year (kWh/year) = Sum(64)m =	2629.8610	(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
108.6372	96.4410	103.1847	92.2434	90.4996	82.7062	82.3696	84.9255	85.0858	93.5106	97.7919	107.6314		(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.6603	29.0086	23.5914	17.8602	13.3507	11.2712	12.1790	15.8307	21.2479	26.9791	31.4886	33.5681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	345.0940	348.6750	339.6510	320.4400	296.1896	273.3976	258.1711	254.5901	263.6141	282.8251	307.0756	329.8676	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)													
	146.0178	143.5134	138.6892	128.1158	121.6393	114.8697	110.7119	114.1471	118.1747	125.6863	135.8221	144.6659	(72)
Total internal gains													
	628.0108	625.4357	606.1703	570.6547	535.4182	503.7772	485.3006	488.8066	507.2754	539.7291	578.6249	612.3402	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	744.3637	852.4107	981.3755	1124.6286	1223.2626	1212.5441	1158.1252	1060.2641	945.4509	809.1559	723.5166	708.1822	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	
alpha	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	
util living area													
	0.9616	0.9372	0.8820	0.7708	0.6143	0.4520	0.3319	0.3768	0.5952	0.8384	0.9401	0.9675	(86)
Living	19.6036	19.8540	20.2367	20.6290	20.8716	20.9686	20.9924	20.9878	20.9144	20.5585	19.9930	19.5310	
Non living	18.4513	18.7627	19.2302	19.6881	19.9481	20.0386	20.0562	20.0537	19.9962	19.6232	18.9419	18.3604	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2857	19.8540	20.2367	20.6290	20.8716	20.9686	20.9924	20.9878	20.9144	20.5585	19.9930	19.7365	(87)
Th 2	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	(88)
util rest of house													
	0.9545	0.9260	0.8621	0.7363	0.5648	0.3903	0.2625	0.3024	0.5282	0.8039	0.9274	0.9614	(89)
MIT 2	19.4184	18.7627	19.2302	19.6881	19.9481	20.0386	20.0562	20.0537	19.9962	19.6232	18.9419	18.6666	(90)
Living area fraction										fLA = Living area / (4) =		0.2308	(91)
MIT	19.6185	19.0145	19.4624	19.9052	20.1612	20.2532	20.2722	20.2693	20.2081	19.8390	19.1845	18.9135	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6185	19.0145	19.4624	19.9052	20.1612	20.2532	20.2722	20.2693	20.2081	19.8390	19.1845	18.9135	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9506	0.9109	0.8476	0.7302	0.5704	0.4032	0.2784	0.3193	0.5393	0.7947	0.9128	0.9520	(94)
Useful gains	707.6064	776.4430	831.8616	821.2007	697.7498	488.9277	322.3921	338.4955	509.8419	643.0761	660.4528	674.1549	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
1352.6121	1246.2982	1144.5715	971.7513	747.1189	499.1754	324.2545	341.6520	539.3370	815.7993	1067.0480	1299.1902		(97)
Space heating kWh													
479.8842	315.7427	232.6562	108.3964	36.7306	0.0000	0.0000	0.0000	0.0000	128.5061	292.7485	465.0262		(98a)
Space heating requirement - total per year (kWh/year)												2059.6909	
Solar heating kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
479.8842	315.7427	232.6562	108.3964	36.7306	0.0000	0.0000	0.0000	0.0000	128.5061	292.7485	465.0262		(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2059.6909	
Space heating per m2											(98c) / (4) =	23.9945	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	263.8000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	479.8842	315.7427	232.6562	108.3964	36.7306	0.0000	0.0000	0.0000	0.0000	128.5061	292.7485	465.0262	(98)

Space heating efficiency (main heating system 1)

	263.8000	263.8000	263.8000	263.8000	263.8000	0.0000	0.0000	0.0000	0.0000	263.8000	263.8000	263.8000 (210)

Space heating fuel (main heating system)

	181.9121	119.6902	88.1941	41.0904	13.9236	0.0000	0.0000	0.0000	0.0000	48.7134	110.9736	176.2798 (211)

Space heating efficiency (main heating system 2)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)

Space heating fuel (main heating system 2)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

Space heating fuel (secondary)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924 (64)

Efficiency of water heater 183.5390 (216)

(217)m	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390 (217)

Fuel for water heating, kWh/month

	143.1398	126.5299	134.2053	117.4015	113.4191	101.7736	100.0971	104.2851	105.6729	118.3529	126.4935	141.4917 (219)

Space cooling fuel requirement

(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	2.6714	2.4129	2.6714	2.5852	2.6714	2.5852	2.6714	2.6714	2.5852	2.6714	2.5852	2.6714 (231)
Lighting	28.5874	22.9339	20.6494	15.1286	11.6858	9.5474	10.6602	13.8565	17.9982	23.6147	26.6727	29.3819 (232)

Electricity generated by PVs (Appendix M) (negative quantity)

(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

Electricity generated by PVs (Appendix M) (negative quantity)

(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)

Electricity generated by wind turbines (Appendix M) (negative quantity)

(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)

Electricity generated by hydro-electric generators (Appendix M) (negative quantity)

(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)

Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)

(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year

Space heating fuel - main system 1 780.7773 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 183.5390
Water heating fuel used 1432.8625 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)
mechanical ventilation fans (SFP = 0.1201) 31.4536 (230a)
Total electricity for the above, kWh/year 31.4536 (231)
Electricity for lighting (calculated in Appendix L) 230.7168 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation 0.0000 (233)
Wind generation 0.0000 (234)
Hydro-electric generation (Appendix N) 0.0000 (235a)
Electricity generated - Micro CHP (Appendix N) 0.0000 (235)
Appendix Q - special features
Energy saved or generated -0.0000 (236)
Energy used 0.0000 (237)
Total delivered energy for all uses 2475.8101 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	624.6218	17.5600	122.4259	(240)
Space heating - main system 1 (low-rate cost)	156.1555	0.0940	14.6786	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1003.0037	19.6000	196.5887	(245)
Low-rate cost	429.8587	9.4000	40.4067	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	31.4536	18.5800	5.2345	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	230.7168	18.5800	42.8672	(250)
Additional standing charges			7.0000	(251)
Total energy cost			429.2016	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.3600 (256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] = 1.1809 (257)
SAP value 80.8572
SAP rating (Section 12) 81 (258)
SAP band B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	624.6218	0.1641	102.5143	(261)
Space heating - main system 1 (low-rate cost)	156.1555	0.1378	21.5156	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1003.0037	0.1479	148.3814	(264)
Water heating - low rate cost	429.8587	0.1242	53.3713	(264)
Space and water heating			325.7826	(265)
Pumps, fans and electric keep-hot	31.4536	0.1432	4.3644	(267)
Energy for lighting	230.7168	0.1490	34.3814	(268)
Total CO2, kg/year			364.5284	(272)
CO2 emissions per m2			4.2500	(273)

EI value 96.2667
EI rating 96 (274)
EI band A

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200 (1b)	x	2.4000 (2b)	=	103.0080	(1b) - (3b)
First floor	42.9200 (1c)	x	2.6000 (2c)	=	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.6000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13335.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.3511 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12 Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1 Party wall - Ground floor	8.0300	0.3200	2.5696
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380
E5 Ground floor (normal)	18.7100	0.0670	1.2536
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7693 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.8901 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

(38)m	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	(38)
Heat transfer coeff	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	(39)
Average = Sum(39)m / 12 =												88.2991	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	(40)
HLP (average)												1.0286	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5644	(42)
Hot water usage for mixer showers	67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)
Hot water usage for baths	29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)
Hot water usage for other uses	40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)
Average daily hot water use (litres/day)												126.0595	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)
Energy content (annual)										Total = Sum(45)m =		2093.8220	
Distribution loss (46)m = 0.15 x (45)m	32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(64)
										Total per year (kWh/year) = Sum(64)m =		2629.8610	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	108.6372	96.4410	103.1847	92.2434	90.4996	82.7062	82.3696	84.9255	85.0858	93.5106	97.7919	107.6314	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.6603	29.0086	23.5914	17.8602	13.3507	11.2712	12.1790	15.8307	21.2479	26.9791	31.4886	33.5681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	345.0940	348.6750	339.6510	320.4400	296.1896	273.3976	258.1711	254.5901	263.6141	282.8251	307.0756	329.8676	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)	146.0178	143.5134	138.6892	128.1158	121.6393	114.8697	110.7119	114.1471	118.1747	125.6863	135.8221	144.6659	(72)
Total internal gains	628.0108	625.4357	606.1703	570.6547	535.4182	503.7772	485.3006	488.8066	507.2754	539.7291	578.6249	612.3402	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	14.2607	0.3900	0.0000	0.7700	18.8857	(74)
East	7.5200	26.6540	0.3900	0.0000	0.7700	60.1916	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	157.6787	259.8706	423.7356	639.9162	765.0027	842.2931	803.1923	685.7050	530.5121	329.0180	189.2193	129.4516	(83)
Total gains	785.6895	885.3063	1029.9059	1210.5708	1300.4209	1346.0703	1288.4929	1174.5116	1037.7875	868.7472	767.8442	741.7918	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	
alpha	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	
util living area	0.9463	0.9202	0.8476	0.7011	0.5174	0.3373	0.2255	0.2472	0.4685	0.7549	0.9069	0.9527	(86)
Living	19.8171	20.0131	20.3965	20.7582	20.9382	20.9906	20.9985	20.9980	20.9684	20.7444	20.2504	19.7819	

Non living	18.7190	18.9596	19.4206	19.8290	20.0111	20.0545	20.0591	20.0590	20.0402	19.8282	19.2578	18.6765	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3949	20.0131	20.3965	20.7582	20.9382	20.9906	20.9985	20.9980	20.9684	20.7444	20.2504	19.9523	(87)
Th 2	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	(88)
util rest of house	0.9362	0.9061	0.8226	0.6604	0.4636	0.2778	0.1616	0.1772	0.3971	0.7064	0.8871	0.9435	(89)
MIT 2	19.5251	18.9596	19.4206	19.8290	20.0111	20.0545	20.0591	20.0590	20.0402	19.8282	19.2578	18.9257	(90)
Living area fraction										fLA = Living area / (4) =		0.2308	(91)
MIT	19.7258	19.2028	19.6458	20.0434	20.2251	20.2705	20.2759	20.2757	20.2544	20.0396	19.4868	19.1626	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7258	19.2028	19.6458	20.0434	20.2251	20.2705	20.2759	20.2757	20.2544	20.0396	19.4868	19.1626	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9321	0.8906	0.8103	0.6596	0.4733	0.2913	0.1763	0.1933	0.4122	0.7053	0.8727	0.9327	(94)
Useful gains	732.3611	788.4725	834.5783	798.5415	615.4714	392.0858	227.1923	227.0686	427.7924	612.6959	670.1229	691.8695	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1273.7891	1192.2812	1081.2932	895.6532	637.9666	394.7407	227.4511	227.4287	437.4703	709.8905	970.1290	1206.3978	(97)
Space heating kWh	402.8224	271.3594	183.5559	69.9204	16.7364	0.0000	0.0000	0.0000	0.0000	72.3127	216.0044	382.8090	(98a)
Space heating requirement - total per year (kWh/year)												1615.5208	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	402.8224	271.3594	183.5559	69.9204	16.7364	0.0000	0.0000	0.0000	0.0000	72.3127	216.0044	382.8090	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1615.5208	
Space heating per m2											(98c) / (4) =	18.8201	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												263.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.8224	271.3594	183.5559	69.9204	16.7364	0.0000	0.0000	0.0000	0.0000	72.3127	216.0044	382.8090	(98)
Space heating efficiency (main heating system 1)	263.8000	263.8000	263.8000	263.8000	263.8000	0.0000	0.0000	0.0000	0.0000	263.8000	263.8000	263.8000	(210)
Space heating fuel (main heating system)	152.6999	102.8656	69.5815	26.5051	6.3444	0.0000	0.0000	0.0000	0.0000	27.4119	81.8819	145.1133	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.7174	232.2317	246.3190	215.4774	208.1683	186.7943	183.7172	191.4039	193.9510	217.2238	232.1648	259.6924	(64)
Efficiency of water heater												183.5390	(216)
(217)m	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	(217)
Fuel for water heating, kWh/month	143.1398	126.5299	134.2053	117.4015	113.4191	101.7736	100.0971	104.2851	105.6729	118.3529	126.4935	141.4917	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.6714	2.4129	2.6714	2.5852	2.6714	2.5852	2.6714	2.6714	2.5852	2.6714	2.5852	2.6714	(231)
Lighting	28.5874	22.9339	20.6494	15.1286	11.6858	9.5474	10.6602	13.8565	17.9982	23.6147	26.6727	29.3819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	612.4035	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5390	
Water heating fuel used	1432.8625	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	31.4536	(230a)
Total electricity for the above, kWh/year	31.4536	(231)
Electricity for lighting (calculated in Appendix L)	230.7168	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2307.4363	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	489.9228	27.8600	152.8559	(240)
Space heating - main system 1 (low-rate cost)	122.4807	0.1450	17.7597	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1003.0037	31.2000	312.9372	(245)
Low-rate cost	429.8587	14.5000	62.3295	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	31.4536	29.5300	8.2902	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	230.7168	29.5300	68.1307	(250)
Additional standing charges			3.0000	(251)
Total energy cost			625.3032	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	489.9228	0.1651	80.8949	(261)
Space heating - main system 1 (low-rate cost)	122.4807	0.1386	16.9771	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1003.0037	0.1479	148.3814	(264)
Water heating - low rate cost	429.8587	0.1242	53.3713	(264)
Space and water heating			299.6247	(265)
Pumps, fans and electric keep-hot	31.4536	0.1432	4.3644	(267)
Energy for lighting	230.7168	0.1490	34.3814	(268)
Total CO2, kg/year			338.3704	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	489.9228	1.2922	791.3502	(275)
Space heating - main system 1 (low-rate cost)	122.4807	1.5022	183.9964	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1003.0037	1.5530	1557.6528	(278)
Water heating - low rate cost	429.8587	1.4443	620.8580	(278)
Space and water heating			3153.8574	(279)
Pumps, fans and electric keep-hot	31.4536	1.5335	47.5878	(281)
Energy for lighting	230.7168	1.5547	358.7056	(282)
Total Primary energy kWh/year			3560.1509	(286)

SAP 10 EPC IMPROVEMENTS

3B5P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.1	-£ 96	-47 kg (13.8%)
U Solar photovoltaic panels	+ 9.1	-£ 332	-265 kg (90.9%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£96	0.55 kg/m²	B 83	A 97
Solar photovoltaic panels	£332	3.09 kg/m²	A 92	A 99
Total Savings	£428	3.63 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£625	£529	£96
Space heating	£182	£206	-£24
Water heating	£375	£255	£120
Lighting	£68	£68	£0
Generated (PV)	-£0	-£332	£332
Total cost of fuels	£625	£197	£428
Total cost of uses	£625	£197	£428
Delivered energy	27 kWh/m²	-1 kWh/m²	28 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	4 kg/m²
Primary energy	41 kWh/m²	13 kWh/m²	28 kWh/m²

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200 (1b)	x	2.4000 (2b)	=	103.0080	(1b) - (3b)
First floor	42.9200 (1c)	x	2.6000 (2c)	=	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	85.8400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		13335.3400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							155.3511	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12 Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1 Party wall - Ground floor	8.0300	0.3200	2.5696
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380
E5 Ground floor (normal)	18.7100	0.0670	1.2536
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7693 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.8901 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	(38)
Heat transfer coeff	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	(39)
Average = Sum(39)m / 12 =												88.2991	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

HLP	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	(40)
HLP (average)												1.0286	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.5644	(42)
Hot water usage for mixer showers													
	67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)
Hot water usage for baths													
	29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)
Hot water usage for other uses													
	40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)
Average daily hot water use (litres/day)												126.0595	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)
Energy content (annual)											Total = Sum(45)m =	2093.8220	
Distribution loss (46)m = 0.15 x (45)m													
	32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	262.7174	232.2317	244.9232	208.7238	195.3740	174.1876	170.6902	179.3074	188.5481	215.8280	232.1648	259.6924	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												615.9427	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												615.9427	
Solar input	-0.0000	-16.2160	-58.1101	-79.6027	-103.5033	-95.2247	-94.4097	-82.8277	-57.4121	-28.6364	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.7174	216.0157	186.8131	129.1211	91.8707	78.9628	76.2805	96.4797	131.1360	187.1916	232.1648	259.6924	(64)
										Total per year (kWh/year) = Sum(64)m =		1948.4458	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	108.6372	96.4410	102.0681	86.8405	80.2642	72.6208	71.9481	75.2483	80.7635	92.3940	97.7919	107.6314	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.6603	29.0086	23.5914	17.8602	13.3507	11.2712	12.1790	15.8307	21.2479	26.9791	31.4886	33.5681	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	345.0940	348.6750	339.6510	320.4400	296.1896	273.3976	258.1711	254.5901	263.6141	282.8251	307.0756	329.8676	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)
Water heating gains (Table 5)													
	146.0178	143.5134	137.1884	120.6118	107.8820	100.8623	96.7044	101.1402	112.1715	124.1855	135.8221	144.6659	(72)
Total internal gains													
	628.0108	625.4357	604.6695	563.1507	521.6609	489.7697	471.2931	475.7996	501.2722	538.2283	578.6249	612.3402	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	10.6334	0.3900	0.0000	0.7700	14.0820	(74)
East	7.5200	19.6403	0.3900	0.0000	0.7700	44.3527	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	116.3529	226.9749	375.2052	553.9739	687.8443	708.7669	672.8246	571.4575	438.1755	269.4267	144.8917	95.8420	(83)
Total gains	744.3637	852.4107	979.8747	1117.1246	1209.5052	1198.5367	1144.1177	1047.2572	939.4477	807.6551	723.5166	708.1822	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	
alpha	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	
util living area	0.9616	0.9372	0.8824	0.7735	0.6196	0.4568	0.3358	0.3813	0.5982	0.8391	0.9401	0.9675	(86)
Living	19.6036	19.8540	20.2350	20.6241	20.8678	20.9675	20.9921	20.9873	20.9130	20.5572	19.9930	19.5310	
Non living	18.4513	18.7627	19.2282	19.6827	19.9446	20.0378	20.0560	20.0534	19.9950	19.6217	18.9419	18.3604	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2857	19.8540	20.2350	20.6241	20.8678	20.9675	20.9921	20.9873	20.9130	20.5572	19.9930	19.7365	(87)
Th 2	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	(88)
util rest of house	0.9545	0.9260	0.8626	0.7392	0.5700	0.3945	0.2657	0.3061	0.5310	0.8046	0.9274	0.9614	(89)
MIT 2	19.4184	18.7627	19.2282	19.6827	19.9446	20.0378	20.0560	20.0534	19.9950	19.6217	18.9419	18.6666	(90)
Living area fraction										fLA = Living area / (4) =		0.2308	(91)
MIT	19.6185	19.0145	19.4605	19.9000	20.1577	20.2524	20.2720	20.2690	20.2068	19.8376	19.1845	18.9135	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6185	19.0145	19.4605	19.9000	20.1577	20.2524	20.2720	20.2690	20.2068	19.8376	19.1845	18.9135	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9506	0.9109	0.8481	0.7329	0.5754	0.4076	0.2817	0.3231	0.5420	0.7954	0.9128	0.9520	(94)
Useful gains	707.6064	776.4430	831.0393	818.7756	695.9737	488.4744	322.2973	338.3369	509.2233	642.4215	660.4528	674.1549	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1352.6121	1246.2982	1144.4049	971.2872	746.8038	499.0987	324.2384	341.6251	539.2287	815.6701	1067.0480	1299.1902	(97)
Space heating kWh	479.8842	315.7427	233.1440	109.8084	37.8176	0.0000	0.0000	0.0000	0.0000	128.8970	292.7485	465.0262	(98a)
Space heating requirement - total per year (kWh/year)												2063.0686	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	479.8842	315.7427	233.1440	109.8084	37.8176	0.0000	0.0000	0.0000	0.0000	128.8970	292.7485	465.0262	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2063.0686	
Space heating per m2											(98c) / (4) =	24.0339	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	263.8000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	479.8842	315.7427	233.1440	109.8084	37.8176	0.0000	0.0000	0.0000	0.0000	128.8970	292.7485	465.0262	(98)
Space heating efficiency (main heating system 1)	263.8000	263.8000	263.8000	263.8000	263.8000	0.0000	0.0000	0.0000	0.0000	263.8000	263.8000	263.8000	(210)
Space heating fuel (main heating system)	181.9121	119.6902	88.3791	41.6256	14.3357	0.0000	0.0000	0.0000	0.0000	48.8616	110.9736	176.2798	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	262.7174	216.0157	186.8131	129.1211	91.8707	78.9628	76.2805	96.4797	131.1360	187.1916	232.1648	259.6924	(64)
Efficiency of water heater												183.5390	(216)
(217)m	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	(217)
Fuel for water heating, kWh/month	143.1398	117.6948	101.7839	70.3508	50.0551	43.0224	41.5609	52.5663	71.4486	101.9901	126.4935	141.4917	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.4659	8.5499	9.4659	9.1606	9.4659	9.1606	9.4659	9.4659	9.1606	9.4659	9.1606	9.4659	(231)
Lighting	28.5874	22.9339	20.6494	15.1286	11.6858	9.5474	10.6602	13.8565	17.9982	23.6147	26.6727	29.3819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.1200	-54.3861	-80.0740	-90.2869	-95.9057	-88.4582	-87.2357	-82.4428	-73.3821	-62.0689	-41.2674	-31.7516	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.9665	-29.1939	-62.2723	-100.4852	-139.7771	-143.2555	-141.4158	-117.3312	-83.0810	-44.7770	-18.1424	-10.1623	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	782.0577	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.5390	
Water heating fuel used	1061.5979	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	31.4536	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	111.4536	(231)

Electricity for lighting (calculated in Appendix L)	230.7168	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	458.5866	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	625.6462	17.5600	122.6267	(240)
Space heating - main system 1 (low-rate cost)	156.4115	0.0940	14.7027	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	743.1185	19.6000	145.6512	(245)
Low-rate cost	318.4794	9.4000	29.9371	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	31.4536	18.5800	5.2345	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	230.7168	18.5800	42.8672	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-824.3793	18.5800	-153.1697	
PV Unit electricity exported	-902.8601	5.5900	-50.4699	
Total			-203.6396	(252)
Total energy cost			179.2438	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4932	(257)
SAP value		92.0055	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	625.6462	0.1641	102.6648	(261)
Space heating - main system 1 (low-rate cost)	156.4115	0.1378	21.5472	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	743.1185	0.1530	113.7160	(264)
Water heating - low rate cost	318.4794	0.1284	40.9056	(264)
Space and water heating			278.8335	(265)
Pumps, fans and electric keep-hot	111.4536	0.1432	15.8206	(267)
Energy for lighting	230.7168	0.1490	34.3814	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-824.3793	0.1389	-114.4932	
PV Unit electricity exported	-902.8601	0.1239	-111.8847	
Total			-226.3779	(269)
Total CO2, kg/year			102.6576	(272)
CO2 emissions per m2			1.2000	(273)
EI value			98.9486	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	42.9200 (1b)	x	2.4000 (2b)	=	103.0080	(1b) - (3b)
First floor	42.9200 (1c)	x	2.6000 (2c)	=	111.5920	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 85.8400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	214.6000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)

Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			21.7500	0.6998	15.2216			(27)
Heatloss Floor 1			42.9200	0.1100	4.7212	75.0000	3219.0000	(28a)
External Wall 1	93.5500	23.7100	69.8400	0.1800	12.5712	60.0000	4190.4000	(29a)
External Roof 1	42.9200		42.9200	0.0900	3.8628	9.0000	386.2800	(30)
Total net area of external elements Aum(A, m2)			179.3900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.1208			(33)
Main dwelling								
Party Wall 1			40.1500	0.0000	0.0000	70.0000	2810.5000	(32)
Internal Wall 1			174.4800			9.0000	1570.3200	(32c)
Internal Floor 1			42.9200			18.0000	772.5600	(32d)
Internal Ceiling 1			42.9200			9.0000	386.2800	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	13335.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.3511 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	10.7200	0.0980	1.0506
E12 Gable (insulation at ceiling level)	8.0300	0.0970	0.7789
P1 Party wall - Ground floor	8.0300	0.3200	2.5696
P2 Party wall - Intermediate floor within a dwelling	8.0300	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0300	0.4800	3.8544
E2 Other lintels (including other steel lintels)	12.3800	0.0500	0.6190
E3 Sill	11.4500	0.0450	0.5152
E4 Jamb	38.0000	0.0510	1.9380
E5 Ground floor (normal)	18.7100	0.0670	1.2536
E6 Intermediate floor within a dwelling	18.7100	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7693 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	52.8901 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	35.4090	(38)
Heat transfer coeff													
	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	88.2991	(39)
Average = Sum(39)m / 12 =												88.2991	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	1.0286	(40)
HLP (average)												1.0286	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5644	(42)

Hot water usage for mixer showers

67.2162	66.2061	64.7341	61.9178	59.8394	57.5216	56.2042	57.6650	59.2664	61.7549	64.6318	66.9587	(42a)

Hot water usage for baths

29.0284	28.5973	27.9902	26.8708	26.0326	25.1032	24.6012	25.2041	25.8604	26.8549	27.9974	28.9303	(42b)

Hot water usage for other uses

40.8920	39.4050	37.9180	36.4310	34.9440	33.4571	33.4571	34.9440	36.4310	37.9180	39.4050	40.8920	(42c)
Average daily hot water use (litres/day)											126.0595	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	137.1366	134.2083	130.6423	125.2196	120.8161	116.0819	114.2625	117.8131	121.5578	126.5279	132.0341	136.7809	(44)
Energy conte	217.1908	191.1109	200.7924	171.4194	162.6417	142.7363	138.1906	145.8773	149.8930	171.6972	188.1068	214.1658	(45)
Energy content (annual)										Total = Sum(45)m =		2093.8220	
Distribution loss (46)m = 0.15 x (45)m													
	32.5786	28.6666	30.1189	25.7129	24.3963	21.4104	20.7286	21.8816	22.4839	25.7546	28.2160	32.1249	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	262.7174	232.2317	244.9232	208.7238	195.3740	174.1876	170.6902	179.3074	188.5481	215.8280	232.1648	259.6924	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.8000	(H2)
Collector linear heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0000	(H4)
Collector loop efficiency	0.9000	(H5)
Incidence angle modifier	1.0000	(H6)
Overshading factor	0.8000	(H8)
Overall heat loss coefficient of system	6.5000	(H10)
Heat loss coefficient of collector loop	3.9667	(H11)
Dedicated solar storage volume	75.0000	(H12)
Effective solar volume	75.0000	(H14)
Reference volume	225.0000	(H15)
Storage tank correction coefficient	1.3161	(H16)
Heat delivered to hot water	774.1121	(H24)
Heat delivered to space heating	0.0000	(H29)
Solar input	774.1121	

Solar input	-6.4175	-23.9719	-69.5501	-95.3301	-116.6220	-114.6505	-113.9953	-102.6939	-75.6061	-44.5831	-10.6916	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	256.2999	208.2598	175.3731	113.3937	78.7520	59.5370	56.6949	76.6136	112.9420	171.2449	221.4732	259.6924	(64)

Total per year (kWh/year) = Sum(64)m = 1790.2765 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	108.6372	96.4410	102.0681	86.8405	80.2642	72.6208	71.9481	75.2483	80.7635	92.3940	97.7919	107.6314	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	153.8637	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	32.6603	29.0086	23.5914	17.8602	13.3507	11.2712	12.1790	15.8307	21.2479	26.9791	31.4886	33.5681	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	345.0940	348.6750	339.6510	320.4400	296.1896	273.3976	258.1711	254.5901	263.6141	282.8251	307.0756	329.8676	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	52.9508	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	-102.5758	(71)

Water heating gains (Table 5)

	146.0178	143.5134	137.1884	120.6118	107.8820	100.8623	96.7044	101.1402	112.1715	124.1855	135.8221	144.6659	(72)

Total internal gains

	628.0108	625.4357	604.6695	563.1507	521.6609	489.7697	471.2931	475.7996	501.2722	538.2283	578.6249	612.3402	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.4100	14.2607	0.3900	0.0000	0.7700	18.8857	(74)
East	7.5200	26.6540	0.3900	0.0000	0.7700	60.1916	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	157.6787	259.8706	423.7356	639.9162	765.0027	842.2931	803.1923	685.7050	530.5121	329.0180	189.2193	129.4516	(83)
Total gains	785.6895	885.3063	1028.4051	1203.0668	1286.6636	1332.0628	1274.4854	1161.5046	1031.7843	867.2464	767.8442	741.7918	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	41.9513	
alpha	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	3.7968	
util living area	0.9463	0.9202	0.8480	0.7039	0.5221	0.3407	0.2280	0.2499	0.4709	0.7556	0.9069	0.9527	(86)
Living	19.8171	20.0131	20.3951	20.7547	20.9362	20.9902	20.9985	20.9979	20.9679	20.7435	20.2504	19.7819	
Non living	18.7190	18.9596	19.4190	19.8255	20.0095	20.0543	20.0591	20.0589	20.0398	19.8273	19.2578	18.6765	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3949	20.0131	20.3951	20.7547	20.9362	20.9902	20.9985	20.9979	20.9679	20.7435	20.2504	19.9523	(87)
Th 2	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	20.0595	(88)
util rest of house	0.9362	0.9061	0.8232	0.6633	0.4680	0.2807	0.1633	0.1792	0.3992	0.7072	0.8871	0.9435	(89)
MIT 2	19.5251	18.9596	19.4190	19.8255	20.0095	20.0543	20.0591	20.0589	20.0398	19.8273	19.2578	18.9257	(90)
Living area fraction									fLA = Living area / (4) =			0.2308	(91)
MIT	19.7258	19.2028	19.6442	20.0399	20.2234	20.2703	20.2759	20.2756	20.2540	20.0387	19.4868	19.1626	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7258	19.2028	19.6442	20.0399	20.2234	20.2703	20.2759	20.2756	20.2540	20.0387	19.4868	19.1626	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9321	0.8906	0.8108	0.6624	0.4777	0.2943	0.1783	0.1955	0.4144	0.7060	0.8727	0.9327	(94)
Useful gains	732.3611	788.4725	833.8770	796.8730	614.6193	391.9713	227.1797	227.0509	427.5820	612.2710	670.1229	691.8695	(95)

Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1273.7891	1192.2812	1081.1535	895.3452	637.8203	394.7214	227.4488	227.4255	437.4345	709.8104	970.1290	1206.3978	(97)
Space heating kWh	402.8224	271.3594	183.9737	70.9000	17.2616	0.0000	0.0000	0.0000	0.0000	72.5693	216.0044	382.8090	(98a)
Space heating requirement - total per year (kWh/year)												1617.6999	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	402.8224	271.3594	183.9737	70.9000	17.2616	0.0000	0.0000	0.0000	0.0000	72.5693	216.0044	382.8090	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1617.6999	
Space heating per m2											(98c) / (4) =	18.8455	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												263.8000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	402.8224	271.3594	183.9737	70.9000	17.2616	0.0000	0.0000	0.0000	0.0000	72.5693	216.0044	382.8090	(98)
Space heating efficiency (main heating system 1)	263.8000	263.8000	263.8000	263.8000	263.8000	0.0000	0.0000	0.0000	0.0000	263.8000	263.8000	263.8000	(210)
Space heating fuel (main heating system)	152.6999	102.8656	69.7398	26.8764	6.5434	0.0000	0.0000	0.0000	0.0000	27.5092	81.8819	145.1133	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	256.2999	208.2598	175.3731	113.3937	78.7520	59.5370	56.6949	76.6136	112.9420	171.2449	221.4732	259.6924	(64)
Efficiency of water heater												183.5390	(216)
(217)m	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	183.5390	(217)
Fuel for water heating, kWh/month	139.6433	113.4690	95.5509	61.7818	42.9075	32.4383	30.8898	41.7424	61.5357	93.3016	120.6682	141.4917	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.4659	8.5499	9.4659	9.1606	9.4659	9.1606	9.4659	9.4659	9.1606	9.4659	9.1606	9.4659	(231)
Lighting	28.5874	22.9339	20.6494	15.1286	11.6858	9.5474	10.6602	13.8565	17.9982	23.6147	26.6727	29.3819	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.7362	-59.0648	-85.0243	-95.7322	-99.1527	-94.3966	-93.2162	-88.9681	-80.6730	-69.2612	-49.7092	-40.0335	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.9336	-34.9569	-73.2359	-121.9928	-160.6558	-178.9477	-177.5590	-148.1984	-106.0640	-59.0053	-26.4971	-15.5766	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												613.2296	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.5390	
Water heating fuel used												975.4204	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												31.4536	(230a)
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												111.4536	(231)
Electricity for lighting (calculated in Appendix L)												230.7168	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2024.5910	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												-93.7707	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	490.5837	27.8600	153.0621	(240)
Space heating - main system 1 (low-rate cost)	122.6459	0.1450	17.7837	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	682.7943	31.2000	213.0318	(245)
Low-rate cost	292.6261	14.5000	42.4308	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	31.4536	29.5300	8.2902	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	230.7168	29.5300	68.1307	(250)
Additional standing charges			3.0000	(251)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-901.9679	29.5300	-266.3511	
PV Unit electricity exported	-1122.6231	5.8100	-65.2244	
Total			-331.5755	(252)
Total energy cost			197.7777	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	490.5837	0.1651	80.9930	(261)
Space heating - main system 1 (low-rate cost)	122.6459	0.1386	16.9976	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	682.7943	0.1544	105.4115	(264)
Water heating - low rate cost	292.6261	0.1296	37.9198	(264)
Space and water heating			241.3219	(265)
Pumps, fans and electric keep-hot	111.4536	0.1432	15.8206	(267)
Energy for lighting	230.7168	0.1490	34.3814	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-901.9679	0.1394	-125.7256	
PV Unit electricity exported	-1122.6231	0.1240	-139.1973	
Total			-264.9229	(269)
Total CO2, kg/year			26.6009	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	490.5837	1.2921	792.3781	(275)
Space heating - main system 1 (low-rate cost)	122.6459	1.5022	184.2354	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	682.7943	1.5763	1076.3217	(278)
Water heating - low rate cost	292.6261	1.4661	429.0169	(278)
Space and water heating			2481.9522	(279)
Pumps, fans and electric keep-hot	111.4536	1.5335	170.2666	(281)
Energy for lighting	230.7168	1.5547	358.7056	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-901.9679	1.5196	-1370.6031	
PV Unit electricity exported	-1122.6231	0.4549	-510.7351	
Total			-1881.3383	(283)
Total Primary energy kWh/year			1129.5862	(286)

Full SAP Calculation Printout

Property Reference	HT12 Havant	**Issued on Date**	22/06/2025
Assessment Reference	3B5P ASHP	**Prop Type Ref**	3B5P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	3.99	**TER**	10.15
Environmental	96 A	**% DER < TER**			60.69
CO_2 Emissions (t/year)	0.37	**DFEE**	32.82	**TFEE**	36.58
Compliance Check	See BREL	**% DFEE < TFEE**			10.27
% DPER < TPER	20.91	**DPER**	41.80	**TPER**	52.85

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
First floor	51.1700 (1c)	x	2.6000 (2c)	=	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.8500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15963.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.9804 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.3743 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.6257 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	(38)
Heat transfer coeff	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	(39)

Average = Sum(39)m / 12 = 97.8409

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	(40)
HLP (average)												0.9560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7602 (42)

Hot water usage for mixer showers

70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284	(42a)

Hot water usage for baths

30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)

Hot water usage for other uses

42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)

Average daily hot water use (litres/day) 132.2170 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)

Energy content (annual) Total = Sum(45)m = 2196.0963

Distribution loss (46)m = 0.15 x (45)m

34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss / Combi loss

Total heat required for water heating calculated for each month

273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS / PV diverter / Solar input / FGHRS

Output from w/h

273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(64)

Total per year (kWh/year) = Sum(64)m = 2732.1353 (64)

12Total per year (kWh/year) 2732 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

112.1647	99.5449	106.4458	95.0274	93.1411	85.0243	84.6140	87.2947	87.5203	96.2992	100.8471	111.1098	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.6254	150.1567	135.6254	140.1463	135.6254	140.1463	135.6254	135.6254	140.1463	135.6254	140.1463	135.6254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.0561	262.7547	255.9544	241.4773	223.2027	206.0271	194.5527	191.8541	198.6544	213.1315	231.4061	248.5818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)
Water heating gains (Table 5)	150.7590	148.1322	143.0723	131.9824	125.1896	118.0893	113.7285	117.3316	121.5560	129.4344	140.0654	149.3411	(72)
Total internal gains	610.8429	625.4460	599.0544	578.0084	548.4200	528.6650	508.3089	509.2135	524.7590	542.5937	576.0201	597.9507	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.3900	0.0000	0.7700	57.7411	(76)

West			9.8200	19.6403	0.3900	0.0000	0.7700					57.9181	(80)
Solar gains	115.6592	226.2540	372.6080	543.4266	665.9897	681.7590	649.0624	557.5350	433.3586	268.4694	144.2134	95.1125	(83)
Total gains	726.5022	851.7000	971.6625	1121.4350	1214.4098	1210.4240	1157.3713	1066.7484	958.1176	811.0631	720.2336	693.0632	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	
alpha	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	
util living area	0.9783	0.9594	0.9191	0.8219	0.6724	0.4990	0.3676	0.4142	0.6431	0.8801	0.9619	0.9818	(86)
Living	19.5510	19.8101	20.1750	20.5886	20.8534	20.9652	20.9920	20.9871	20.9075	20.5233	19.9528	19.4881	
Non living	18.4280	18.7537	19.2061	19.6985	19.9894	20.0962	20.1164	20.1137	20.0494	19.6361	18.9375	18.3485	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2587	19.8101	20.1750	20.5886	20.8534	20.9652	20.9920	20.9871	20.9075	20.5233	19.9528	19.6996	(87)
Th 2	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	(88)
util rest of house	0.9741	0.9518	0.9044	0.7922	0.6249	0.4364	0.2960	0.3382	0.5781	0.8521	0.9535	0.9782	(89)
MIT 2	19.4455	18.7537	19.2061	19.6985	19.9894	20.0962	20.1164	20.1137	20.0494	19.6361	18.9375	18.6677	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	19.5563	18.8976	19.3381	19.8197	20.1071	20.2146	20.2357	20.2327	20.1663	19.7569	19.0758	18.8083	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5563	18.8976	19.3381	19.8197	20.1071	20.2146	20.2357	20.2327	20.1663	19.7569	19.0758	18.8083	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9709	0.9383	0.8887	0.7810	0.6242	0.4433	0.3055	0.3481	0.5817	0.8386	0.9404	0.9712	(94)
Useful gains	705.3266	799.1820	863.5147	875.8317	758.0358	536.5816	353.5670	371.3419	557.3396	680.1407	677.2971	673.1022	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1492.6901	1369.5341	1256.0867	1068.3956	822.5594	549.3385	355.7167	374.9924	593.5287	895.9206	1171.7273	1429.2887	(97)
Space heating kWh	585.7984	383.2766	292.0736	138.6460	48.0055	0.0000	0.0000	0.0000	0.0000	160.5402	355.9897	562.6028	(98a)
Space heating requirement - total per year (kWh/year)												2526.9329	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	585.7984	383.2766	292.0736	138.6460	48.0055	0.0000	0.0000	0.0000	0.0000	160.5402	355.9897	562.6028	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2526.9329	
Space heating per m2										(98c) / (4) =		24.6915	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 262.1174 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	585.7984	383.2766	292.0736	138.6460	48.0055	0.0000	0.0000	0.0000	0.0000	160.5402	355.9897	562.6028	(98)
Space heating efficiency (main heating system 1)	262.1174	262.1174	262.1174	262.1174	262.1174	0.0000	0.0000	0.0000	0.0000	262.1174	262.1174	262.1174	(210)
Space heating fuel (main heating system)	223.4871	146.2233	111.4285	52.8946	18.3145	0.0000	0.0000	0.0000	0.0000	61.2475	135.8131	214.6377	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(64)
Efficiency of water heater												183.4219	(216)
(217)m	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	(217)
Fuel for water heating, kWh/month	149.0152	131.7000	139.6379	122.0412	117.8226	105.6395	103.8410	108.2364	109.7321	123.0009	131.5836	147.2854	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.1849	2.8767	3.1849	3.0822	3.1849	3.0822	3.1849	3.1849	3.0822	3.1849	3.0822	3.1849	(231)
Lighting	33.8467	27.1531	24.4483	17.9119	13.8357	11.3039	12.6214	16.4057	21.3094	27.9591	31.5797	34.7874	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												964.0463	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.4219	
Water heating fuel used	1489.5359	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	37.4995	(230a)
Total electricity for the above, kWh/year	37.4995	(231)
Electricity for lighting (calculated in Appendix L)	273.1622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2764.2439	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	771.2370	0.1640	126.4826	(261)
Space heating - main system 1 (low-rate cost)	192.8093	0.1377	26.5458	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1042.6751	0.1480	154.2742	(264)
Water heating - low rate cost	446.8608	0.1242	55.4909	(264)
Space and water heating			362.7935	(265)
Pumps, fans and electric keep-hot	37.4995	0.1432	5.2033	(267)
Energy for lighting	273.1622	0.1490	40.7066	(268)
Total CO2, kg/year			408.7034	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.9900	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	771.2370	1.2890	1242.6595	(275)
Space heating - main system 1 (low-rate cost)	192.8093	1.4985	288.9320	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1042.6751	1.5531	1619.3489	(278)
Water heating - low rate cost	446.8608	1.4444	645.4492	(278)
Space and water heating			3796.3896	(279)
Pumps, fans and electric keep-hot	37.4995	1.5335	56.7351	(281)
Energy for lighting	273.1622	1.5547	424.6975	(282)
Total Primary energy kWh/year			4277.8221	(286)
Dwelling Primary energy Rate (DPER)			41.8000	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700	(1b) x	2.4000	(2b) =	122.8080	(1b) - (3b)
First floor	51.1700	(1c) x	2.6000	(2c) =	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.8500	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1563	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4063	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3454	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4404	0.4317	0.4231	0.3799	0.3713	0.3281	0.3281	0.3195	0.3454	0.3713	0.3886	0.4058 (22b)
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5824 (25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.6100	1.1450	22.4542			(27)
Heatloss Floor 1			51.1700	0.1300	6.6521			(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494			(29a)
External Roof 1	51.1700		51.1700	0.1100	5.6287			(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.2444			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.9804 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.6000	0.0600	0.6960
E12 Gable (insulation at ceiling level)	8.7700	0.0600	0.5262
P1 Party wall - Ground floor	8.7700	0.0800	0.7016
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.1200	1.0524
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0500	0.4955
E4 Jamb	35.7000	0.0500	1.7850
E5 Ground floor (normal)	20.4800	0.1600	3.2768
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5755 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 61.8199 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.4020	50.0841	49.7725	48.3089	48.0350	46.7603	46.7603	46.5242	47.2513	48.0350	48.5890	49.1681	(38)
Heat transfer coeff	112.2219	111.9040	111.5924	110.1288	109.8549	108.5802	108.5802	108.3441	109.0712	109.8549	110.4089	110.9880	(39)
Average = Sum(39)m / 12 =												110.1275	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0966	1.0935	1.0904	1.0761	1.0734	1.0610	1.0610	1.0587	1.0658	1.0734	1.0788	1.0845	(40)
HLP (average)												1.0761	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7602 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284	(42a)
Hot water usage for baths	30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)
Hot water usage for other uses	42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)
Average daily hot water use (litres/day)												132.2170	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)
Energy content (annual)										Total = Sum(45)m =		2196.0963	
Distribution loss (46)m = 0.15 x (45)m	34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	279.5464	247.1847	262.3466	229.8697	222.3324	199.7854	196.6871	204.7494	207.2921	231.8306	247.3726	276.3738 (62)
WWHRS	-32.2290	-28.5036	-29.8473	-24.7148	-23.0333	-19.7097	-18.4747	-19.6460	-20.3924	-24.0404	-27.2349	-31.6322 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	247.3175	218.6811	232.4993	205.1549	199.2991	180.0757	178.2123	185.1033	186.8997	207.7902	220.1377	244.7416 (64)
									Total per year (kWh/year) = Sum(64)m =			2505.9123 (64)
12Total per year (kWh/year)												2506 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	117.1407	104.0393	111.4218	99.8428	98.1170	89.8398	89.5900	92.2707	92.3358	101.2752	105.6625	116.0858 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
132.7578 146.9818 132.7578 137.1831 132.7578 137.1831 132.7578 132.7578 137.1831 132.7578 137.1831 132.7578 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
260.0561 262.7547 255.9544 241.4773 223.2027 206.0271 194.5527 191.8541 198.6544 213.1315 231.4061 248.5818 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 36.8008 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 0.0000 0.0000 0.0000 0.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 -110.4063 (71)
Water heating gains (Table 5)
157.4472 154.8204 149.7604 138.6706 131.8778 124.7775 120.4166 124.0198 128.2441 136.1226 146.7535 156.0293 (72)
Total internal gains
617.6635 631.9593 605.8750 584.7334 555.2406 532.3900 512.1295 513.0340 528.4840 549.4142 582.7451 604.7712 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.6300	0.7000	0.7700	58.7627	(76)
West	9.8200	19.6403	0.6300	0.7000	0.7700	58.9428	(80)

Solar gains	117.7055	230.2569	379.2003	553.0411	677.7726	693.8209	660.5458	567.3991	441.0257	273.2192	146.7649	96.7953 (83)
Total gains	735.3690	862.2162	985.0753	1137.7745	1233.0132	1226.2109	1172.6753	1080.4331	969.5097	822.6335	729.5100	701.5665 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.5126	39.6248	39.7355	40.2635	40.3639	40.8378	40.8378	40.9268	40.6540	40.3639	40.1614	39.9518	
alpha	3.6342	3.6417	3.6490	3.6842	3.6909	3.7225	3.7225	3.7285	3.7103	3.6909	3.6774	3.6635	
util living area	0.9794	0.9632	0.9290	0.8439	0.7075	0.5349	0.3987	0.4470	0.6788	0.8940	0.9649	0.9824	(86)
MIT	19.2559	19.5308	19.9357	20.4340	20.7730	20.9404	20.9845	20.9765	20.8561	20.3809	19.7383	19.2177	(87)
Th 2	20.0036	20.0062	20.0087	20.0204	20.0226	20.0328	20.0328	20.0347	20.0289	20.0226	20.0181	20.0135	(88)
util rest of house	0.9752	0.9559	0.9149	0.8145	0.6572	0.4642	0.3148	0.3591	0.6090	0.8667	0.9566	0.9788	(89)
MIT 2	17.9765	18.3245	18.8308	19.4393	19.8198	19.9922	20.0258	20.0233	19.9188	19.3940	18.5987	17.9346	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	18.1508	18.4888	18.9813	19.5748	19.9496	20.1214	20.1564	20.1531	20.0465	19.5284	18.7539	18.1094	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1508	18.4888	18.9813	19.5748	19.9496	20.1214	20.1564	20.1531	20.0465	19.5284	18.7539	18.1094	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9642	0.9409	0.8966	0.7992	0.6532	0.4709	0.3257	0.3702	0.6103	0.8500	0.9422	0.9689	(94)
Useful gains	709.0232	811.2692	883.2460	909.2939	805.3761	577.4065	381.9881	399.9259	591.7141	699.2416	687.3446	679.7276	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1554.3580	1520.6451	1392.8220	1175.5980	906.2632	599.5125	386.1547	406.6258	648.5905	980.8310	1286.6945	1543.7792	(97)
Space heating kWh	628.9290	476.7006	379.1246	191.7389	75.0600	0.0000	0.0000	0.0000	0.0000	209.5026	431.5319	642.8544	(98a)
Space heating requirement - total per year (kWh/year)												3035.4420	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	628.9290	476.7006	379.1246	191.7389	75.0600	0.0000	0.0000	0.0000	0.0000	209.5026	431.5319	642.8544	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3035.4420	
Space heating per m2											(98c) / (4) =	29.6604	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 92.3000 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	628.9290	476.7006	379.1246	191.7389	75.0600	0.0000	0.0000	0.0000	0.0000	209.5026	431.5319	642.8544	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	681.3966	516.4687	410.7525	207.7345	81.3218	0.0000	0.0000	0.0000	0.0000	226.9800	467.5319	696.4836	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.3175	218.6811	232.4993	205.1549	199.2991	180.0757	178.2123	185.1033	186.8997	207.7902	220.1377	244.7416	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0605	85.7584	85.1494	83.9084	82.0758	79.8000	79.8000	79.8000	79.8000	84.0782	85.5410	86.1218	(217)
Fuel for water heating, kWh/month	287.3763	254.9967	273.0485	244.4987	242.8232	225.6587	223.3237	231.9591	234.2101	247.1392	257.3475	284.1808	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	27.5844	22.1293	19.9250	14.5979	11.2758	9.2124	10.2862	13.3704	17.3668	22.7862	25.7369	28.3511	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.6939	-65.2347	-92.9233	-103.4882	-110.7331	-103.0058	-101.6743	-96.3648	-86.9242	-74.0657	-51.0991	-40.4349	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-28.2291	-59.1618	-117.2007	-175.4922	-231.5606	-232.5329	-229.8504	-194.8836	-143.1660	-84.4935	-37.6479	-22.3446	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3288.6695	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3006.5626	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	222.6223	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2529.2055	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4074.6490	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3288.6695	0.2100	690.6206	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3006.5626	0.2100	631.3781	(264)
Space and water heating			1321.9987	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	222.6223	0.1443	32.1313	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-972.6421	0.1348	-131.1055	
PV Unit electricity exported	-1556.5634	0.1260	-196.0970	
Total			-327.2025	(269)
Total CO2, kg/year			1038.8568	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3288.6695	1.1300	3716.1966	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3006.5626	1.1300	3397.4157	(278)
Space and water heating			7113.6123	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	222.6223	1.5338	341.4655	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-972.6421	1.4982	-1457.1970	
PV Unit electricity exported	-1556.5634	0.4624	-719.8164	
Total			-2177.0134	(283)
Total Primary energy kWh/year			5408.1652	(286)
Target Primary Energy Rate (TPER)			52.8500	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
First floor	51.1700 (1c)	x	2.6000 (2c)	=	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.8500	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1563	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3563	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3029	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3862	0.3786	0.3710	0.3332	0.3256	0.2877	0.2877	0.2802	0.3029	0.3256	0.3408	0.3559	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5746	0.5717	0.5688	0.5555	0.5530	0.5414	0.5414	0.5392	0.5459	0.5530	0.5581	0.5633	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15963.0300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.9804	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3743	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 55.6257	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.5112	48.2667	48.0271	46.9015	46.6909	45.7106	45.7106	45.5290	46.0882	46.6909	47.1169	47.5623	(38)
Heat transfer coeff	104.1368	103.8924	103.6527	102.5272	102.3166	101.3362	101.3362	101.1547	101.7138	102.3166	102.7426	103.1880	(39)
Average = Sum(39)m / 12 =												102.5261	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0176	1.0152	1.0128	1.0018	0.9998	0.9902	0.9902	0.9884	0.9939	0.9998	1.0039	1.0083	(40)
HLP (average)												1.0018	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7602	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)
Hot water usage for other uses	42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)
Average daily hot water use (litres/day)												67.2197	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.3367	71.3247	69.1282	66.3945	63.9557	61.4212	60.8948	63.0869	65.3350	67.9378	70.6956	73.2338	(44)
Energy conte	116.1474	101.5655	106.2475	90.8908	86.0967	75.5246	73.6470	78.1147	80.5646	92.1909	100.7189	114.6664	(45)
Energy content (annual)										Total = Sum(45)m =		1116.3750	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	98.7253	86.3306	90.3104	77.2572	73.1822	64.1959	62.5999	66.3975	68.4800	78.3623	85.6111	97.4664	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	98.7253	86.3306	90.3104	77.2572	73.1822	64.1959	62.5999	66.3975	68.4800	78.3623	85.6111	97.4664	(64)
									Total per year (kWh/year) = Sum(64)m =			948.9187	(64)
12Total per year (kWh/year)												949	(64)
Electric shower(s)													
	56.4576	50.3042	54.9302	52.4193	53.4029	50.9412	52.6392	53.4029	52.4193	54.9302	53.8973	56.4576	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							642.2019	(64a)
Heat gains from water heating, kWh/month													
	38.7957	34.1587	36.3102	32.4191	31.6463	28.7843	28.8098	29.9501	30.2248	33.3231	34.8771	38.4810	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	135.6254	150.1567	135.6254	140.1463	135.6254	140.1463	135.6254	135.6254	140.1463	135.6254	140.1463	135.6254	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	260.0561	262.7547	255.9544	241.4773	223.2027	206.0271	194.5527	191.8541	198.6544	213.1315	231.4061	248.5818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)
Water heating gains (Table 5)													
	52.1448	50.8314	48.8040	45.0265	42.5353	39.9781	38.7228	40.2555	41.9789	44.7892	48.4404	51.7218	(72)
Total internal gains													
	512.2287	528.1452	504.7861	491.0525	465.7657	450.5538	433.3033	432.1374	445.1819	457.9484	484.3952	500.3313	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.3900	0.0000	0.7700	57.7411	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	115.6592	226.2540	372.6080	543.4266	665.9897	681.7590	649.0624	557.5350	433.3586	268.4694	144.2134	95.1125	(83)
Total gains	627.8879	754.3991	877.3942	1034.4791	1131.7555	1132.3128	1082.3656	989.6724	878.5405	726.4178	628.6086	595.4438	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.5803	42.6805	42.7791	43.2488	43.3378	43.7571	43.7571	43.8356	43.5946	43.3378	43.1581	42.9718	
alpha	3.8387	3.8454	3.8519	3.8833	3.8892	3.9171	3.9171	3.9224	3.9063	3.8892	3.8772	3.8648	
util living area													
	0.9871	0.9738	0.9435	0.8605	0.7215	0.5433	0.4043	0.4569	0.6988	0.9149	0.9763	0.9894	(86)
MIT	19.2722	19.5510	19.9565	20.4568	20.7906	20.9481	20.9872	20.9796	20.8634	20.3804	19.7383	19.2290	(87)
Th 2	20.0687	20.0707	20.0727	20.0818	20.0835	20.0915	20.0915	20.0930	20.0884	20.0835	20.0801	20.0764	(88)
util rest of house													
	0.9844	0.9684	0.9321	0.8339	0.6738	0.4755	0.3241	0.3723	0.6324	0.8923	0.9706	0.9872	(89)
MIT 2	18.4881	18.7647	19.1622	19.6419	19.9358	20.0634	20.0869	20.0850	20.0052	19.5839	18.9592	18.4509	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	18.5949	18.8718	19.2704	19.7529	20.0523	20.1839	20.2095	20.2069	20.1221	19.6924	19.0653	18.5569	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5949	18.8718	19.2704	19.7529	20.0523	20.1839	20.2095	20.2069	20.1221	19.6924	19.0653	18.5569	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9786	0.9595	0.9199	0.8231	0.6720	0.4827	0.3347	0.3832	0.6350	0.8807	0.9623	0.9821	(94)
Useful gains	614.4742	723.8691	807.1540	851.5275	760.5860	546.5170	362.3004	379.2240	557.8897	639.7263	604.9065	584.8047	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1488.6241	1451.5643	1323.6889	1112.7214	854.5762	565.8546	365.7725	385.0824	612.5350	930.3032	1229.3487	1481.4568	(97)
Space heating kWh													
	650.3675	489.0112	384.3020	188.0596	69.9287	0.0000	0.0000	0.0000	0.0000	216.1892	449.5984	667.1092	(98a)
Space heating requirement - total per year (kWh/year)												3114.5657	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	650.3675	489.0112	384.3020	188.0596	69.9287	0.0000	0.0000	0.0000	0.0000	216.1892	449.5984	667.1092	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3114.5657	
Space heating per m2											(98c) / (4) =	30.4335	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

	0.0000	0.0000	0.0000	0.0000	0.0000	952.5605	749.8881	768.7756	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8921	0.9355	0.9118	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	849.7438	701.5316	700.9644	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1265.7333	1210.0909	1104.4605	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	299.5124	378.3681	300.2010	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	74.8781	94.5920	75.0503	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												244.5204	(107)
Energy for space heating												30.4335	(99)
Energy for space cooling												2.3893	(108)
Total												32.8228	(109)
Fabric Energy Efficiency (DFEE)												32.8	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
First floor	51.1700 (1c)	x	2.6000 (2c)	=	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.8500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1563	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4063	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3454	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4404	0.4317	0.4231	0.3799	0.3713	0.3281	0.3281	0.3195	0.3454	0.3713	0.3886	0.4058	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5970	0.5932	0.5895	0.5722	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5755	0.5824	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.6100	1.1450	22.4542			(27)
Heatloss Floor 1			51.1700	0.1300	6.6521			(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494			(29a)
External Roof 1	51.1700		51.1700	0.1100	5.6287			(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.2444			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.9804 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.6000	0.0600	0.6960
E12 Gable (insulation at ceiling level)	8.7700	0.0600	0.5262
P1 Party wall - Ground floor	8.7700	0.0800	0.7016
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.1200	1.0524
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0500	0.4955
E4 Jamb	35.7000	0.0500	1.7850
E5 Ground floor (normal)	20.4800	0.1600	3.2768
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000

E18 Party wall between dwellings									10.0000	0.0600	0.6000		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												10.5755	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		61.8199	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.4020	50.0841	49.7725	48.3089	48.0350	46.7603	46.7603	46.5242	47.2513	48.0350	48.5890	49.1681	(38)
Heat transfer coeff	112.2219	111.9040	111.5924	110.1288	109.8549	108.5802	108.5802	108.3441	109.0712	109.8549	110.4089	110.9880	(39)
Average = Sum(39)m / 12 =												110.1275	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0966	1.0935	1.0904	1.0761	1.0734	1.0610	1.0610	1.0587	1.0658	1.0734	1.0788	1.0845	(40)
HLP (average)												1.0761	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7602	(42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)
Hot water usage for other uses	42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)
Average daily hot water use (litres/day)												67.2197	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.3367	71.3247	69.1282	66.3945	63.9557	61.4212	60.8948	63.0869	65.3350	67.9378	70.6956	73.2338	(44)
Energy conte	116.1474	101.5655	106.2475	90.8908	86.0967	75.5246	73.6470	78.1147	80.5646	92.1909	100.7189	114.6664	(45)
Energy content (annual)										Total = Sum(45)m =		1116.3750	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	98.7253	86.3306	90.3104	77.2572	73.1822	64.1959	62.5999	66.3975	68.4800	78.3623	85.6111	97.4664	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	98.7253	86.3306	90.3104	77.2572	73.1822	64.1959	62.5999	66.3975	68.4800	78.3623	85.6111	97.4664	(64)
									Total per year (kWh/year) = Sum(64)m =			948.9187	(64)
12Total per year (kWh/year)												949	(64)
Electric shower(s)	56.4576	50.3042	54.9302	52.4193	53.4029	50.9412	52.6392	53.4029	52.4193	54.9302	53.8973	56.4576	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			642.2019	(64a)
Heat gains from water heating, kWh/month	38.7957	34.1587	36.3102	32.4191	31.6463	28.7843	28.8098	29.9501	30.2248	33.3231	34.8771	38.4810	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	138.0079	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.7578	146.9818	132.7578	137.1831	132.7578	137.1831	132.7578	132.7578	137.1831	132.7578	137.1831	132.7578	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.0561	262.7547	255.9544	241.4773	223.2027	206.0271	194.5527	191.8541	198.6544	213.1315	231.4061	248.5818	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	36.8008	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)
Water heating gains (Table 5)	52.1448	50.8314	48.8040	45.0265	42.5353	39.9781	38.7228	40.2555	41.9789	44.7892	48.4404	51.7218	(72)
Total internal gains	509.3611	524.9703	501.9185	488.0893	462.8981	447.5906	430.4357	429.2698	442.2187	455.0808	481.4320	497.4637	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.6300	0.7000	0.7700	58.7627	(76)
West	9.8200	19.6403	0.6300	0.7000	0.7700	58.9428	(80)

Solar gains	117.7055	230.2569	379.2003	553.0411	677.7726	693.8209	660.5458	567.3991	441.0257	273.2192	146.7649	96.7953	(83)
Total gains	627.0666	755.2272	881.1189	1041.1304	1140.6708	1141.4115	1090.9815	996.6688	883.2444	728.3000	628.1969	594.2590	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	39.5126	39.6248	39.7355	40.2635	40.3639	40.8378	40.8378	40.9268	40.6540	40.3639	40.1614	39.9518	
alpha	3.6342	3.6417	3.6490	3.6842	3.6909	3.7225	3.7225	3.7285	3.7103	3.6909	3.6774	3.6635	
util living area													

	0.9875	0.9751	0.9473	0.8714	0.7415	0.5673	0.4263	0.4804	0.7206	0.9217	0.9775	0.9896	(86)
MIT	19.1031	19.3885	19.8139	20.3537	20.7326	20.9277	20.9807	20.9702	20.8231	20.2834	19.6019	19.0643	(87)
Th 2	20.0036	20.0062	20.0087	20.0204	20.0226	20.0328	20.0328	20.0347	20.0289	20.0226	20.0181	20.0135	(88)
util rest of house													
	0.9848	0.9699	0.9362	0.8453	0.6927	0.4944	0.3375	0.3875	0.6520	0.8998	0.9720	0.9874	(89)
MIT 2	18.2733	18.5570	18.9752	19.4967	19.8337	19.9938	20.0259	20.0232	19.9210	19.4449	18.7794	18.2419	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	18.3863	18.6702	19.0895	19.6134	19.9562	20.1210	20.1560	20.1522	20.0439	19.5592	18.8914	18.3539	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3863	18.6702	19.0895	19.6134	19.9562	20.1210	20.1560	20.1522	20.0439	19.5592	18.8914	18.3539	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9788	0.9606	0.9233	0.8327	0.6890	0.5014	0.3491	0.3992	0.6532	0.8869	0.9633	0.9821	(94)
Useful gains	613.7453	725.4518	813.5219	866.9956	785.9701	572.2822	380.8473	397.9019	576.9269	645.9195	605.1411	583.6510	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1580.7916	1540.9424	1404.8905	1179.8536	906.9801	599.4753	386.1071	406.5257	648.3088	984.2069	1301.8798	1570.9138	(97)
Space heating kWh													
	719.4824	548.0097	439.9783	225.2577	90.0315	0.0000	0.0000	0.0000	0.0000	251.6859	501.6519	734.5235	(98a)
Space heating requirement - total per year (kWh/year)												3510.6209	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	719.4824	548.0097	439.9783	225.2577	90.0315	0.0000	0.0000	0.0000	0.0000	251.6859	501.6519	734.5235	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3510.6209	
Space heating per m2											(98c) / (4) =	34.3035	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1020.6537	803.4933	823.4153	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8671	0.9168	0.8892	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	884.9984	736.6313	732.2208	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1279.5807	1223.2420	1115.6375	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	284.0993	362.0384	285.2620	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	71.0248	90.5096	71.3155	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												232.8499	(107)
Energy for space heating												34.3035	(99)
Energy for space cooling												2.2753	(108)
Total												36.5788	(109)
Fabric Energy Efficiency (TFEE)												36.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700	(1b)	x 2.4000	(2b) =	122.8080	(1b) - (3b)
First floor	51.1700	(1c)	x 2.6000	(2c) =	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.8500	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15963.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 155.9804 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.3743 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 55.6257 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	(38)
Heat transfer coeff	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	(39)

Average = Sum(39)m / 12 = 97.8409

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	(40)
HLP (average)												0.9560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7602 (42)
Hot water usage for mixer showers

70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284	(42a)

Hot water usage for baths

30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)

Hot water usage for other uses

42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)

Average daily hot water use (litres/day) 132.2170 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)
Energy content (annual)										Total = Sum(45)m =		2196.0963	
Distribution loss (46)m = 0.15 x (45)m	34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(64)

Total per year (kWh/year) = Sum(64)m = 2732.1353 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	112.1647	99.5449	106.4458	95.0274	93.1411	85.0243	84.6140	87.2947	87.5203	96.2992	100.8471	111.1098 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	38.6689	34.3454	27.9316	21.1460	15.8069	13.3448	14.4196	18.7431	25.1569	31.9425	37.2816	39.7437 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	388.1435	392.1712	382.0215	360.4139	333.1383	307.5031	290.3772	286.3494	296.4991	318.1067	345.3823	371.0176 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063 (71)

Water heating gains (Table 5)

	150.7590	148.1322	143.0723	131.9824	125.1896	118.0893	113.7285	117.3316	121.5560	129.4344	140.0654	149.3411 (72)

Total internal gains

	687.0957	684.1731	662.5496	623.0666	583.6590	548.4615	528.0494	531.9484	552.7363	589.0079	632.2535	669.6266 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.3900	0.0000	0.7700	57.7411	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	115.6592	226.2540	372.6080	543.4266	665.9897	681.7590	649.0624	557.5350	433.3586	268.4694	144.2134	95.1125	(83)
Total gains	802.7549	910.4271	1035.1576	1166.4932	1249.6488	1230.2205	1177.1118	1089.4833	986.0949	857.4773	776.4670	764.7391	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	
alpha	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	
util living area	0.9700	0.9503	0.9042	0.8067	0.6588	0.4919	0.3616	0.4061	0.6293	0.8629	0.9521	0.9748	(86)
Living	19.6576	19.8855	20.2424	20.6189	20.8639	20.9670	20.9924	20.9880	20.9144	20.5643	20.0257	19.5902	
Non living	18.5618	18.8470	19.2866	19.7319	19.9994	20.0975	20.1166	20.1142	20.0551	19.6819	19.0273	18.4771	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3133	19.8855	20.2424	20.6189	20.8639	20.9670	20.9924	20.9880	20.9144	20.5643	20.0257	19.7874	(87)
Th 2	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	(88)
util rest of house	0.9643	0.9413	0.8875	0.7758	0.6113	0.4299	0.2911	0.3314	0.5646	0.8325	0.9418	0.9700	(89)
MIT 2	19.4989	18.8470	19.2866	19.7319	19.9994	20.0975	20.1166	20.1142	20.0551	19.6819	19.0273	18.7731	(90)
Living area fraction									fLA = Living area / (4) =			0.1362	(91)
MIT	19.6098	18.9884	19.4168	19.8527	20.1171	20.2159	20.2359	20.2332	20.1721	19.8021	19.1633	18.9113	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6098	18.9884	19.4168	19.8527	20.1171	20.2159	20.2359	20.2332	20.1721	19.8021	19.1633	18.9113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9605	0.9268	0.8719	0.7655	0.6111	0.4368	0.3005	0.3411	0.5686	0.8199	0.9277	0.9615	(94)
Useful gains	771.0491	843.8240	902.5329	892.9729	763.6667	537.3622	353.7180	371.6513	560.6987	703.0362	720.2913	735.3329	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1497.9265	1378.4242	1263.7888	1071.6199	823.5409	549.4672	355.7415	375.0431	594.1039	900.3433	1180.2860	1439.3656	(97)
Space heating kWh	540.7968	359.2513	268.7744	128.6259	44.5464	0.0000	0.0000	0.0000	0.0000	146.7965	331.1962	523.8004	(98a)
Space heating requirement - total per year (kWh/year)												2343.7878	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	540.7968	359.2513	268.7744	128.6259	44.5464	0.0000	0.0000	0.0000	0.0000	146.7965	331.1962	523.8004	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2343.7878	
Space heating per m2										(98c) / (4) =		22.9020	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	262.1174	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	540.7968	359.2513	268.7744	128.6259	44.5464	0.0000	0.0000	0.0000	0.0000	146.7965	331.1962	523.8004	(98)
Space heating efficiency (main heating system 1)	262.1174	262.1174	262.1174	262.1174	262.1174	0.0000	0.0000	0.0000	0.0000	262.1174	262.1174	262.1174	(210)
Space heating fuel (main heating system)	206.3186	137.0574	102.5397	49.0719	16.9948	0.0000	0.0000	0.0000	0.0000	56.0041	126.3542	199.8343	(211)
Space heating efficiency (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
	273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538 (64)
Efficiency of water heater												183.4219 (216)
(217)m	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219 (217)
Fuel for water heating, kWh/month												
	149.0152	131.7000	139.6379	122.0412	117.8226	105.6395	103.8410	108.2364	109.7321	123.0009	131.5836	147.2854 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	3.1849	2.8767	3.1849	3.0822	3.1849	3.0822	3.1849	3.1849	3.0822	3.1849	3.0822	3.1849 (231)
Lighting	33.8467	27.1531	24.4483	17.9119	13.8357	11.3039	12.6214	16.4057	21.3094	27.9591	31.5797	34.7874 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	894.1749 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	183.4219
Water heating fuel used	1489.5359 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)	
mechanical ventilation fans (SFP = 0.1201)	37.4995 (230a)
Total electricity for the above, kWh/year	37.4995 (231)
Electricity for lighting (calculated in Appendix L)	273.1622 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2694.3725 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	715.3399	17.5600	140.2066	(240)
Space heating - main system 1 (low-rate cost)	178.8350	0.0940	16.8105	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1042.6751	19.6000	204.3643	(245)
Low-rate cost	446.8608	9.4000	42.0049	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	37.4995	18.5800	6.2407	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	273.1622	18.5800	50.7535	(250)
Additional standing charges			7.0000	(251)
Total energy cost			467.3805	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1420 (257)
SAP value		81.4888
SAP rating (Section 12)		81 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	715.3399	0.1640	117.3322	(261)
Space heating - main system 1 (low-rate cost)	178.8350	0.1377	24.6255	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1042.6751	0.1480	154.2742	(264)
Water heating - low rate cost	446.8608	0.1242	55.4909	(264)
Space and water heating			351.7229	(265)
Pumps, fans and electric keep-hot	37.4995	0.1432	5.2033	(267)
Energy for lighting	273.1622	0.1490	40.7066	(268)
Total CO2, kg/year			397.6328	(272)
CO2 emissions per m2			3.8900	(273)
EI value			96.3837	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
First floor	51.1700 (1c)	x	2.6000 (2c)	=	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.8500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		15963.0300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							155.9804	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3743	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 55.6257	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	(38)
Heat transfer coeff	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	(39)
Average = Sum(39)m / 12 =												97.8409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	(40)
HLP (average)												0.9560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7602	(42)
Hot water usage for mixer showers													
	70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284	(42a)
Hot water usage for baths													
	30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)
Hot water usage for other uses													
	42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)
Average daily hot water use (litres/day)												132.2170	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)
Energy content (annual)										Total = Sum(45)m =		2196.0963	
Distribution loss (46)m = 0.15 x (45)m													
	34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(64)
										Total per year (kWh/year) = Sum(64)m =		2732.1353	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.1647	99.5449	106.4458	95.0274	93.1411	85.0243	84.6140	87.2947	87.5203	96.2992	100.8471	111.1098	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.6689	34.3454	27.9316	21.1460	15.8069	13.3448	14.4196	18.7431	25.1569	31.9425	37.2816	39.7437	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	388.1435	392.1712	382.0215	360.4139	333.1383	307.5031	290.3772	286.3494	296.4991	318.1067	345.3823	371.0176	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)
Water heating gains (Table 5)													
	150.7590	148.1322	143.0723	131.9824	125.1896	118.0893	113.7285	117.3316	121.5560	129.4344	140.0654	149.3411	(72)
Total internal gains													
	687.0957	684.1731	662.5496	623.0666	583.6590	548.4615	528.0494	531.9484	552.7363	589.0079	632.2535	669.6266	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	26.6540	0.3900	0.0000	0.7700	78.3612	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	156.9625	259.0206	419.9167	625.4903	737.7595	807.0424	771.7684	666.4357	523.2057	327.5600	188.5203	128.7042	(83)
Total gains	844.0582	943.1937	1082.4663	1248.5569	1321.4185	1355.5039	1299.8178	1198.3841	1075.9421	916.5679	820.7738	798.3308	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	
alpha	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	
util living area													
	0.9573	0.9360	0.8740	0.7415	0.5607	0.3707	0.2477	0.2684	0.4999	0.7845	0.9235	0.9626	(86)
Living	19.8573	20.0361	20.3964	20.7485	20.9343	20.9902	20.9986	20.9981	20.9688	20.7465	20.2702	19.8259	
Non living	18.8134	19.0345	19.4721	19.8758	20.0675	20.1147	20.1197	20.1196	20.1005	19.8859	19.3294	18.7751	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4154	20.0361	20.3964	20.7485	20.9343	20.9902	20.9986	20.9981	20.9688	20.7465	20.2702	19.9902	(87)
Th 2	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	(88)

util rest of house													
	0.9492	0.9243	0.8525	0.7037	0.5074	0.3098	0.1820	0.1974	0.4292	0.7399	0.9069	0.9553	(89)
MIT 2	19.5992	19.0345	19.4721	19.8758	20.0675	20.1147	20.1197	20.1196	20.1005	19.8859	19.3294	19.0175	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	19.7104	19.1709	19.5980	19.9947	20.1855	20.2340	20.2394	20.2392	20.2188	20.0031	19.4576	19.1500	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7104	19.1709	19.5980	19.9947	20.1855	20.2340	20.2394	20.2392	20.2188	20.0031	19.4576	19.1500	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9448	0.9090	0.8379	0.6980	0.5115	0.3178	0.1910	0.2070	0.4374	0.7334	0.8916	0.9451	(94)
Useful gains	797.4788	857.3541	907.0032	871.4411	675.8903	430.7930	248.2010	248.0890	470.6021	672.2048	731.7818	754.4675	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1409.9230	1318.0064	1193.4624	987.6731	703.0397	433.8234	248.4601	248.4409	481.2551	783.0351	1072.0978	1335.5262	(97)
Space heating kWh	455.6585	309.5583	213.1257	83.6870	20.1992	0.0000	0.0000	0.0000	0.0000	82.4578	245.0275	432.3076	(98a)
Space heating requirement - total per year (kWh/year)												1842.0216	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	455.6585	309.5583	213.1257	83.6870	20.1992	0.0000	0.0000	0.0000	0.0000	82.4578	245.0275	432.3076	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1842.0216	
Space heating per m2											(98c) / (4) =	17.9990	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												262.1174	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	455.6585	309.5583	213.1257	83.6870	20.1992	0.0000	0.0000	0.0000	0.0000	82.4578	245.0275	432.3076	(98)
Space heating efficiency (main heating system 1)	262.1174	262.1174	262.1174	262.1174	262.1174	0.0000	0.0000	0.0000	0.0000	262.1174	262.1174	262.1174	(210)
Space heating fuel (main heating system)	173.8376	118.0991	81.3093	31.9273	7.7062	0.0000	0.0000	0.0000	0.0000	31.4583	93.4801	164.9290	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.3265	241.5666	256.1266	223.8503	216.1124	193.7661	190.4671	198.5294	201.2728	225.6106	241.3532	270.1538	(64)
Efficiency of water heater												183.4219	(216)
(217)m	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	(217)
Fuel for water heating, kWh/month	149.0152	131.7000	139.6379	122.0412	117.8226	105.6395	103.8410	108.2364	109.7321	123.0009	131.5836	147.2854	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.1849	2.8767	3.1849	3.0822	3.1849	3.0822	3.1849	3.1849	3.0822	3.1849	3.0822	3.1849	(231)
Lighting	33.8467	27.1531	24.4483	17.9119	13.8357	11.3039	12.6214	16.4057	21.3094	27.9591	31.5797	34.7874	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												702.7469	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.4219	
Water heating fuel used												1489.5359	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												37.4995	(230a)
Total electricity for the above, kWh/year												37.4995	(231)
Electricity for lighting (calculated in Appendix L)												273.1622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2502.9444	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	562.1975	27.8600	175.4056	(240)
Space heating - main system 1 (low-rate cost)	140.5494	0.1450	20.3797	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1042.6751	31.2000	325.3146	(245)
Low-rate cost	446.8608	14.5000	64.7948	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	37.4995	29.5300	9.8837	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	273.1622	29.5300	80.6648	(250)
Additional standing charges			3.0000	(251)
Total energy cost			679.4433	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	562.1975	0.1650	92.7852	(261)
Space heating - main system 1 (low-rate cost)	140.5494	0.1385	19.4724	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1042.6751	0.1480	154.2742	(264)
Water heating - low rate cost	446.8608	0.1242	55.4909	(264)
Space and water heating			322.0227	(265)
Pumps, fans and electric keep-hot	37.4995	0.1432	5.2033	(267)
Energy for lighting	273.1622	0.1490	40.7066	(268)
Total CO2, kg/year			367.9326	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	562.1975	1.2920	907.9368	(275)
Space heating - main system 1 (low-rate cost)	140.5494	1.5020	211.1039	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1042.6751	1.5531	1619.3489	(278)
Water heating - low rate cost	446.8608	1.4444	645.4492	(278)
Space and water heating			3383.8388	(279)
Pumps, fans and electric keep-hot	37.4995	1.5335	56.7351	(281)
Energy for lighting	273.1622	1.5547	424.6975	(282)
Total Primary energy kWh/year			3865.2713	(286)

SAP 10 EPC IMPROVEMENTS

3B5P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended	
U	Solar photovoltaic panels	Recommended	
V2	Wind turbine	Not applicable	

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 97	-47 kg (12.9%)
U Solar photovoltaic panels	+ 8.2	-£ 341	-265 kg (82.7%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£97	0.46 kg/m²	B 83	A 97
Solar photovoltaic panels	£341	2.59 kg/m²	A 92	A 99
Total Savings	£438	3.05 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£679	£582	£97
Space heating	£209	£233	-£24
Water heating	£390	£269	£121
Lighting	£81	£81	£0
Generated (PV)	-£0	-£341	£341
Total cost of fuels	£679	£241	£438
Total cost of uses	£680	£242	£438
Delivered energy	24 kWh/m²	1 kWh/m²	24 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	38 kWh/m²	14 kWh/m²	24 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700 (1b)	x	2.4000 (2b)	=	122.8080	(1b) - (3b)
First floor	51.1700 (1c)	x	2.6000 (2c)	=	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.8500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15963.0300	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	155.9804	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3743	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	55.6257	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	(38)
Heat transfer coeff	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	(39)

Average = Sum(39)m / 12 = 97.8409

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	(40)
HLP (average)												0.9560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7602 (42)

Hot water usage for mixer showers

70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284 (42a)

Hot water usage for baths

30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370 (42b)

Hot water usage for other uses

42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968 (42c)

Average daily hot water use (litres/day) 132.2170 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)

Energy content (annual) Total = Sum(45)m = 2196.0963

Distribution loss (46)m = 0.15 x (45)m

	34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

	273.3265	241.5666	254.7309	217.0967	203.3181	181.1593	177.4401	186.4329	195.8699	224.2149	241.3532	270.1538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)

Aperture area of solar collector 3.0000 (H1)

Zero-loss collector efficiency 0.8000 (H2)

Collector linear heat loss coefficient 1.8000 (H3)

Collector 2nd order heat loss coefficient 0.0000 (H4)

Collector loop efficiency 0.9000 (H5)

Incidence angle modifier 1.0000 (H6)

Overshading factor 0.8000 (H8)

Overall heat loss coefficient of system 6.5000 (H10)

Heat loss coefficient of collector loop 3.9667 (H11)

Dedicated solar storage volume 75.0000 (H12)

Effective solar volume 75.0000 (H14)

Reference volume 225.0000 (H15)

Storage tank correction coefficient 1.3161 (H16)

Heat delivered to hot water 621.5851 (H24)

Heat delivered to space heating 0.0000 (H29)

Solar input 621.5851

Solar input	-0.0000	-16.2069	-58.3946	-80.2390	-104.6866	-96.3691	-95.5734	-83.6619	-57.7770	-28.6765	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

	273.3265	225.3597	196.3363	136.8578	98.6314	84.7903	81.8668	102.7710	138.0928	195.5384	241.3532	270.1538	(64)

Total per year (kWh/year) = Sum(64)m = 2045.0778 (64)

Electric shower(s)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	112.1647	99.5449	105.3292	89.6245	82.9056	74.9390	74.1924	77.6175	83.1980	95.1826	100.8471	111.1098	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	38.6689	34.3454	27.9316	21.1460	15.8069	13.3448	14.4196	18.7431	25.1569	31.9425	37.2816	39.7437	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	388.1435	392.1712	382.0215	360.4139	333.1383	307.5031	290.3772	286.3494	296.4991	318.1067	345.3823	371.0176	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)

Water heating gains (Table 5)

	150.7590	148.1322	141.5715	124.4784	111.4323	104.0819	99.7210	104.3247	115.5528	127.9336	140.0654	149.3411	(72)

Total internal gains

	687.0957	684.1731	661.0488	615.5626	569.9017	534.4540	514.0420	518.9414	546.7331	587.5071	632.2535	669.6266	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	19.6403	0.3900	0.0000	0.7700	57.7411	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	115.6592	226.2540	372.6080	543.4266	665.9897	681.7590	649.0624	557.5350	433.3586	268.4694	144.2134	95.1125	(83)
Total gains	802.7549	910.4271	1033.6568	1158.9892	1235.8914	1216.2130	1163.1043	1076.4764	980.0917	855.9765	776.4670	764.7391	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203
alpha	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214

util living area

	0.9700	0.9503	0.9046	0.8093	0.6640	0.4969	0.3658	0.4107	0.6322	0.8635	0.9521	0.9748	(86)
Living	19.6576	19.8855	20.2408	20.6140	20.8599	20.9657	20.9921	20.9875	20.9130	20.5630	20.0257	19.5902	
Non living	18.5618	18.8470	19.2847	19.7265	19.9956	20.0966	20.1165	20.1139	20.0539	19.6805	19.0273	18.4771	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3133	19.8855	20.2408	20.6140	20.8599	20.9657	20.9921	20.9875	20.9130	20.5630	20.0257	19.7874	(87)
Th 2	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	(88)
util rest of house													
	0.9643	0.9413	0.8879	0.7786	0.6166	0.4345	0.2946	0.3353	0.5674	0.8332	0.9418	0.9700	(89)
MIT 2	19.4989	18.8470	19.2847	19.7265	19.9956	20.0966	20.1165	20.1139	20.0539	19.6805	19.0273	18.7731	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	19.6098	18.9884	19.4150	19.8474	20.1133	20.2150	20.2357	20.2329	20.1709	19.8007	19.1633	18.9113	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6098	18.9884	19.4150	19.8474	20.1133	20.2150	20.2357	20.2329	20.1709	19.8007	19.1633	18.9113	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9605	0.9268	0.8723	0.7681	0.6162	0.4414	0.3040	0.3451	0.5714	0.8205	0.9277	0.9615	(94)
Useful gains	771.0491	843.8240	901.6421	890.2068	761.5247	536.8150	353.6121	371.4777	560.0038	702.3255	720.2913	735.3329	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1497.9265	1378.4242	1263.6135	1071.1013	823.1681	549.3770	355.7241	375.0146	593.9851	900.2066	1180.2860	1439.3656	(97)
Space heating kWh													
	540.7968	359.2513	269.3067	130.2441	45.8628	0.0000	0.0000	0.0000	0.0000	147.2235	331.1962	523.8004	(98a)
Space heating requirement - total per year (kWh/year)												2347.6818	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	540.7968	359.2513	269.3067	130.2441	45.8628	0.0000	0.0000	0.0000	0.0000	147.2235	331.1962	523.8004	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2347.6818	
Space heating per m2											(98c) / (4) =	22.9400	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	262.1174	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	540.7968	359.2513	269.3067	130.2441	45.8628	0.0000	0.0000	0.0000	0.0000	147.2235	331.1962	523.8004	(98)
Space heating efficiency (main heating system 1)													
	262.1174	262.1174	262.1174	262.1174	262.1174	0.0000	0.0000	0.0000	0.0000	262.1174	262.1174	262.1174	(210)
Space heating fuel (main heating system)													
	206.3186	137.0574	102.7428	49.6892	17.4970	0.0000	0.0000	0.0000	0.0000	56.1670	126.3542	199.8343	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	273.3265	225.3597	196.3363	136.8578	98.6314	84.7903	81.8668	102.7710	138.0928	195.5384	241.3532	270.1538	(64)
Efficiency of water heater												183.4219	(216)
(217)m	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	(217)
Fuel for water heating, kWh/month													
	149.0152	122.8641	107.0408	74.6136	53.7730	46.2269	44.6330	56.0298	75.2870	106.6058	131.5836	147.2854	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9794	9.0137	9.9794	9.6575	9.9794	9.6575	9.9794	9.9794	9.6575	9.9794	9.6575	9.9794	(231)
Lighting	33.8467	27.1531	24.4483	17.9119	13.8357	11.3039	12.6214	16.4057	21.3094	27.9591	31.5797	34.7874	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.7063	-55.6415	-82.6324	-94.1145	-100.7608	-93.0808	-91.7937	-86.3421	-76.2679	-63.8344	-42.0504	-32.2146	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.3802	-27.9385	-59.7138	-96.6575	-134.9220	-138.6329	-136.8578	-113.4319	-80.1952	-43.0115	-17.3594	-9.6992	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	895.6605	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.4219	
Water heating fuel used	1114.9582	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	37.4995	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	117.4995	(231)
Electricity for lighting (calculated in Appendix L)	273.1622	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	674.0410	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	716.5284	17.5600	140.4396	(240)
Space heating - main system 1 (low-rate cost)	179.1321	0.0940	16.8384	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	780.4708	19.6000	152.9723	(245)
Low-rate cost	334.4875	9.4000	31.4418	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	37.4995	18.5800	6.2407	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	273.1622	18.5800	50.7535	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.4394	18.5800	-159.1264	
PV Unit electricity exported	-870.8000	5.5900	-48.6777	
Total			-207.8042	(252)
Total energy cost			212.7461	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5198	(257)
SAP value		91.5739	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	716.5284	0.1640	117.5065	(261)
Space heating - main system 1 (low-rate cost)	179.1321	0.1377	24.6621	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	780.4708	0.1529	119.3069	(264)
Water heating - low rate cost	334.4875	0.1283	42.9166	(264)
Space and water heating			304.3922	(265)
Pumps, fans and electric keep-hot	117.4995	0.1432	16.6595	(267)
Energy for lighting	273.1622	0.1490	40.7066	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-856.4394	0.1387	-118.7862	
PV Unit electricity exported	-870.8000	0.1238	-107.8150	
Total			-226.6012	(269)
Total CO2, kg/year			135.1571	(272)
CO2 emissions per m2			1.3200	(273)
EI value			98.7708	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.1700	(1b) x	2.4000	(2b) =	122.8080	(1b) - (3b)
First floor	51.1700	(1c) x	2.6000	(2c) =	133.0420	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.3400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		255.8500	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.6100	0.6998	13.7240			(27)
Heatloss Floor 1			51.1700	0.1100	5.6287	75.0000	3837.7500	(28a)
External Wall 1	102.4000	21.5700	80.8300	0.1800	14.5494	60.0000	4849.8000	(29a)
External Roof 1	51.1700		51.1700	0.0900	4.6053	9.0000	460.5300	(30)
Total net area of external elements Aum(A, m2)			204.7400					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2514			(33)
Main dwelling								
Party Wall 1			52.4400	0.0000	0.0000	70.0000	3670.8000	(32)
Internal Wall 1			195.8400			9.0000	1762.5600	(32c)
Internal Floor 1			51.1700			18.0000	921.0600	(32d)
Internal Ceiling 1			51.1700			9.0000	460.5300	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15963.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		155.9804 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	11.6000	0.0980	1.1368
E12 Gable (insulation at ceiling level)	8.7700	0.0970	0.8507
P1 Party wall - Ground floor	8.7700	0.3200	2.8064
P2 Party wall - Intermediate floor within a dwelling	8.7700	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.7700	0.4800	4.2096
E1 Steel lintel with perforated steel base plate	10.8400	0.0500	0.5420
E3 Sill	9.9100	0.0450	0.4460
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.4800	0.0670	1.3722
E6 Intermediate floor within a dwelling	20.4800	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.3743 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	55.6257 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	42.2152	(38)
Heat transfer coeff													
	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	97.8409	(39)
Average = Sum(39)m / 12 =												97.8409	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	0.9560	(40)
HLP (average)												0.9560	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7602	(42)
Hot water usage for mixer showers													
	70.4986	69.4391	67.8953	64.9414	62.7615	60.3306	58.9488	60.4810	62.1605	64.7706	67.7879	70.2284	(42a)
Hot water usage for baths													
	30.4399	29.9878	29.3512	28.1774	27.2985	26.3239	25.7975	26.4296	27.1179	28.1608	29.3588	30.3370	(42b)
Hot water usage for other uses													
	42.8968	41.3369	39.7770	38.2171	36.6572	35.0974	35.0974	36.6572	38.2171	39.7770	41.3369	42.8968	(42c)
Average daily hot water use (litres/day)												132.2170	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.8352	140.7638	137.0235	131.3360	126.7173	121.7518	119.8436	123.5678	127.4955	132.7084	138.4836	143.4622	(44)
Energy conte	227.7999	200.4458	210.6000	179.7923	170.5858	149.7081	144.9405	153.0028	157.2148	180.0840	197.2952	224.6272	(45)
Energy content (annual)										Total = Sum(45)m =		2196.0963	
Distribution loss (46)m = 0.15 x (45)m													
	34.1700	30.0669	31.5900	26.9689	25.5879	22.4562	21.7411	22.9504	23.5822	27.0126	29.5943	33.6941	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.3265	241.5666	254.7309	217.0967	203.3181	181.1593	177.4401	186.4329	195.8699	224.2149	241.3532	270.1538	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												782.2393	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												782.2393	
Solar input	-6.3594	-24.0072	-69.9481	-96.2215	-118.1037	-116.3015	-115.6944	-103.9606	-76.2376	-44.7644	-10.6409	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	266.9671	217.5594	184.7827	120.8752	85.2144	64.8578	61.7458	82.4724	119.6322	179.4505	230.7123	270.1538	(64)
										Total per year (kWh/year) = Sum(64)m =		1884.4236	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.1647	99.5449	105.3292	89.6245	82.9056	74.9390	74.1924	77.6175	83.1980	95.1826	100.8471	111.1098	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	165.6094	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.6689	34.3454	27.9316	21.1460	15.8069	13.3448	14.4196	18.7431	25.1569	31.9425	37.2816	39.7437	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	388.1435	392.1712	382.0215	360.4139	333.1383	307.5031	290.3772	286.3494	296.4991	318.1067	345.3823	371.0176	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	54.3211	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	-110.4063	(71)
Water heating gains (Table 5)													
	150.7590	148.1322	141.5715	124.4784	111.4323	104.0819	99.7210	104.3247	115.5528	127.9336	140.0654	149.3411	(72)
Total internal gains													
	687.0957	684.1731	661.0488	615.5626	569.9017	534.4540	514.0420	518.9414	546.7331	587.5071	632.2535	669.6266	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	9.7900	26.6540	0.3900	0.0000	0.7700	78.3612	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	156.9625	259.0206	419.9167	625.4903	737.7595	807.0424	771.7684	666.4357	523.2057	327.5600	188.5203	128.7042	(83)
Total gains	844.0582	943.1937	1080.9655	1241.0529	1307.6612	1341.4964	1285.8104	1185.3772	1069.9389	915.0671	820.7738	798.3308	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	45.3203	
alpha	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	4.0214	
util living area													
	0.9573	0.9360	0.8744	0.7442	0.5656	0.3744	0.2504	0.2713	0.5024	0.7852	0.9235	0.9626	(86)
Living	19.8573	20.0361	20.3950	20.7450	20.9322	20.9899	20.9985	20.9980	20.9683	20.7456	20.2702	19.8259	
Non living	18.8134	19.0345	19.4705	19.8722	20.0657	20.1145	20.1197	20.1195	20.1001	19.8850	19.3294	18.7751	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4154	20.0361	20.3950	20.7450	20.9322	20.9899	20.9985	20.9980	20.9683	20.7456	20.2702	19.9902	(87)
Th 2	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	20.1201	(88)
util rest of house													
	0.9492	0.9243	0.8530	0.7065	0.5121	0.3130	0.1840	0.1995	0.4315	0.7407	0.9069	0.9553	(89)
MIT 2	19.5992	19.0345	19.4705	19.8722	20.0657	20.1145	20.1197	20.1195	20.1001	19.8850	19.3294	19.0175	(90)
Living area fraction										fLA = Living area / (4) =		0.1362	(91)
MIT	19.7104	19.1709	19.5965	19.9911	20.1838	20.2337	20.2394	20.2392	20.2184	20.0023	19.4576	19.1500	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7104	19.1709	19.5965	19.9911	20.1838	20.2337	20.2394	20.2392	20.2184	20.0023	19.4576	19.1500	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9448	0.9090	0.8384	0.7006	0.5161	0.3210	0.1930	0.2093	0.4396	0.7341	0.8916	0.9451	(94)
Useful gains	797.4788	857.3541	906.2333	869.4925	674.8493	430.6574	248.1879	248.0713	470.3689	671.7365	731.7818	754.4675	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1409.9230	1318.0064	1193.3129	987.3202	702.8650	433.8013	248.4578	248.4379	481.2166	782.9489	1072.0978	1335.5262	(97)
Space heating kWh													
	455.6585	309.5583	213.5872	84.8359	20.8437	0.0000	0.0000	0.0000	0.0000	82.7421	245.0275	432.3076	(98a)
Space heating requirement - total per year (kWh/year)												1844.5608	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

455.6585	309.5583	213.5872	84.8359	20.8437	0.0000	0.0000	0.0000	0.0000	82.7421	245.0275	432.3076	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1844.5608

Space heating per m2 (98c) / (4) = 18.0238 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 262.1174 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	455.6585	309.5583	213.5872	84.8359	20.8437	0.0000	0.0000	0.0000	0.0000	82.7421	245.0275	432.3076	(98)
Space heating efficiency (main heating system 1)													
	262.1174	262.1174	262.1174	262.1174	262.1174	0.0000	0.0000	0.0000	0.0000	262.1174	262.1174	262.1174	(210)
Space heating fuel (main heating system)													
	173.8376	118.0991	81.4853	32.3656	7.9520	0.0000	0.0000	0.0000	0.0000	31.5668	93.4801	164.9290	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	266.9671	217.5594	184.7827	120.8752	85.2144	64.8578	61.7458	82.4724	119.6322	179.4505	230.7123	270.1538	(64)
Efficiency of water heater												183.4219	(216)
(217)m	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	183.4219	(217)
Fuel for water heating, kWh/month													
	145.5481	118.6114	100.7419	65.9001	46.4581	35.3599	33.6632	44.9632	65.2224	97.8348	125.7823	147.2854	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9794	9.0137	9.9794	9.6575	9.9794	9.6575	9.9794	9.9794	9.6575	9.9794	9.6575	9.9794	(231)
Lighting	33.8467	27.1531	24.4483	17.9119	13.8357	11.3039	12.6214	16.4057	21.3094	27.9591	31.5797	34.7874	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.6165	-60.5446	-87.9674	-100.1932	-104.5095	-99.9721	-98.7351	-93.7443	-84.2687	-71.4937	-50.8163	-40.7227	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.0533	-33.4771	-70.2928	-117.5319	-155.2990	-173.3722	-172.0400	-143.4223	-102.4683	-56.7728	-25.3899	-14.8874	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 703.7156 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.4219

Water heating fuel used 1027.3710 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)

mechanical ventilation fans (SFP = 0.1201) 37.4995 (230a)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 117.4995 (231)

Electricity for lighting (calculated in Appendix L) 273.1622 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -2024.5910 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses 97.1573 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	562.9725	27.8600	175.6474	(240)
Space heating - main system 1 (low-rate cost)	140.7431	0.1450	20.4078	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	719.1597	31.2000	224.3778	(245)
Low-rate cost	308.2113	14.5000	44.6906	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	37.4995	29.5300	9.8837	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	273.1622	29.5300	80.6648	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-940.5842	29.5300	-277.7545	
PV Unit electricity exported	-1084.0068	5.8100	-62.9808	
Total			-340.7353	(252)
Total energy cost			241.5609	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	562.9725	0.1650	92.9000	(261)
Space heating - main system 1 (low-rate cost)	140.7431	0.1385	19.4965	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	719.1597	0.1542	110.8755	(264)
Water heating - low rate cost	308.2113	0.1294	39.8852	(264)
Space and water heating			263.1572	(265)
Pumps, fans and electric keep-hot	117.4995	0.1432	16.6595	(267)
Energy for lighting	273.1622	0.1490	40.7066	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-940.5842	0.1392	-130.9009	
PV Unit electricity exported	-1084.0068	0.1239	-134.2855	
Total			-265.1865	(269)
Total CO2, kg/year			55.3369	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	562.9725	1.2919	909.1416	(275)
Space heating - main system 1 (low-rate cost)	140.7431	1.5019	211.3841	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	719.1597	1.5756	1133.1022	(278)
Water heating - low rate cost	308.2113	1.4654	451.6490	(278)
Space and water heating			2705.2770	(279)
Pumps, fans and electric keep-hot	117.4995	1.5335	179.4139	(281)
Energy for lighting	273.1622	1.5547	424.6975	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-940.5842	1.5188	-1428.5245	
PV Unit electricity exported	-1084.0068	0.4545	-492.7049	
Total			-1921.2295	(283)
Total Primary energy kWh/year			1388.1589	(286)

Full SAP Calculation Printout

Property Reference	HT 13 Havant	**Issued on Date**	22/06/2025
Assessment Reference	3B4P ASHP	**Prop Type Ref**	3B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.51	**TER**	11.98
Environmental	96 A	**% DER < TER**			62.35
CO_2 Emissions (t/year)	0.32	**DFEE**	36.04	**TFEE**	39.27
Compliance Check	See BREL	**% DFEE < TFEE**			8.23
% DPER < TPER	24.44	**DPER**	47.29	**TPER**	62.59

Assessor Details	Mrs. Rebecca Lennon	**Assessor ID**	P627-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800 (1b)	x	2.4000 (2b)	=	94.2720	(1b) - (3b)
First floor	39.2800 (1c)	x	2.6000 (2c)	=	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.4000	(5)

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2. Ventilation rate

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			m3 per hour
Number of open chimneys		0 * 80 =	0.0000 (6a)
Number of open flues		0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000 (6d)
Number of flues attached to other heater		0 * 35 =	0.0000 (6e)
Number of blocked chimneys		0 * 20 =	0.0000 (6f)
Number of intermittent extract fans		0 * 10 =	0.0000 (7a)
Number of passive vents		0 * 10 =	0.0000 (7b)
Number of flueless gas fires		0 * 40 =	0.0000 (7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test			Yes
Pressure Test Method			Blower Door
Measured/design AP50			4.0000 (17)
Infiltration rate			0.2000 (18)
Number of sides sheltered			2 (19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12740.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		162.1696 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.3188 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 53.4060 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	(38)
Heat transfer coeff	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	(39)

Average = Sum(39)m / 12 = 85.8120

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	(40)
HLP (average)												1.0923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4350 (42)

Hot water usage for mixer showers

65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969	(42a)

Hot water usage for baths

28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)

Hot water usage for other uses

39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)

Average daily hot water use (litres/day) 121.9886 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)
Energy content (annual)										Total = Sum(45)m =		2026.2055	
Distribution loss (46)m = 0.15 x (45)m	31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)

Water storage loss:

Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)

Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss

Total heat required for water heating calculated for each month

255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS

Output from w/h

255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(64)
									Total per year (kWh/year) = Sum(64)m =		2562.2445	(64)

12Total per year (kWh/year) 2562 (64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

106.3051	94.3890	101.0288	90.4028	88.7533	81.1736	80.8858	83.3591	83.4763	91.6669	95.7721	105.3317	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1513	120.8461	109.1513	112.7897	109.1513	112.7897	109.1513	109.1513	112.7897	109.1513	112.7897	109.1513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.4046	218.6502	212.9914	200.9444	185.7372	171.4446	161.8962	159.6506	165.3095	177.3565	192.5637	206.8563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)	142.8832	140.4598	135.7914	125.5594	119.2921	112.7412	108.7175	112.0418	115.9393	123.2082	133.0168	141.5749	(72)
Total internal gains	527.9636	539.4806	517.4586	498.8180	473.7051	456.4999	439.2896	440.3683	453.5630	469.2406	497.8947	517.1071	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	19.6403	0.3900	0.0000	0.7700	86.8181	(76)

West			9.8200	19.6403	0.3900	0.0000	0.7700				57.9181	(80)
Solar gains	144.7362	283.1347	466.2826	680.0453	833.4211	853.1548	812.2382	697.7006	542.3059	335.9632	180.4690	119.0240 (83)
Total gains	672.6999	822.6154	983.7412	1178.8633	1307.1262	1309.6547	1251.5277	1138.0688	995.8689	805.2038	678.3637	636.1311 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	
alpha	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	
util living area	0.9680	0.9367	0.8709	0.7367	0.5692	0.4098	0.2993	0.3425	0.5571	0.8280	0.9442	0.9735	(86)
Living	19.5010	19.8286	20.2571	20.6744	20.8964	20.9761	20.9943	20.9906	20.9284	20.5673	19.9412	19.4234	
Non living	18.2827	18.6898	19.2100	19.6888	19.9201	19.9919	20.0048	20.0029	19.9564	19.5870	18.8372	18.1852	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2332	19.8286	20.2571	20.6744	20.8964	20.9761	20.9943	20.9906	20.9284	20.5673	19.9412	19.6439	(87)
Th 2	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	(88)
util rest of house	0.9616	0.9249	0.8489	0.6987	0.5183	0.3496	0.2328	0.2705	0.4883	0.7904	0.9317	0.9681	(89)
MIT 2	19.3196	18.6898	19.2100	19.6888	19.9201	19.9919	20.0048	20.0029	19.9564	19.5870	18.8372	18.5135	(90)
Living area fraction										fLA = Living area / (4) =		0.2571	(91)
MIT	19.5545	18.9826	19.4793	19.9422	20.1711	20.2450	20.2592	20.2569	20.2063	19.8391	19.1211	18.8042	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5545	18.9826	19.4793	19.9422	20.1711	20.2450	20.2592	20.2569	20.2063	19.8391	19.1211	18.8042	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9582	0.9100	0.8355	0.6961	0.5270	0.3642	0.2498	0.2888	0.5026	0.7833	0.9176	0.9596	(94)
Useful gains	644.5606	748.6003	821.8676	820.5826	688.8251	477.0128	312.6832	328.6714	500.5303	630.7038	622.4804	610.4586	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1309.0218	1208.4554	1113.7767	947.5517	726.9262	484.4089	314.0032	330.9659	523.9959	792.8218	1031.5535	1253.2116	(97)
Space heating kWh	494.3591	309.0226	217.1804	91.4178	28.3473	0.0000	0.0000	0.0000	0.0000	120.6158	294.5326	478.2082	(98a)
Space heating requirement - total per year (kWh/year)												2033.6839	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	494.3591	309.0226	217.1804	91.4178	28.3473	0.0000	0.0000	0.0000	0.0000	120.6158	294.5326	478.2082	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2033.6839	
Space heating per m2											(98c) / (4) =	25.8870	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 264.6986 (206)
Efficiency of main space heating system 2 (in %) 0.0000 (207)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	494.3591	309.0226	217.1804	91.4178	28.3473	0.0000	0.0000	0.0000	0.0000	120.6158	294.5326	478.2082	(98)
Space heating efficiency (main heating system 1)	264.6986	264.6986	264.6986	264.6986	264.6986	0.0000	0.0000	0.0000	0.0000	264.6986	264.6986	264.6986	(210)
Space heating fuel (main heating system)	186.7631	116.7451	82.0482	34.5366	10.7093	0.0000	0.0000	0.0000	0.0000	45.5672	111.2710	180.6614	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(64)
Efficiency of water heater												183.7140	(216)
(217)m	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	(217)
Fuel for water heating, kWh/month	139.1856	123.0500	130.5479	114.2764	110.4522	99.1677	97.5726	101.6215	102.9373	115.2220	123.0663	137.5922	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.4448	2.2082	2.4448	2.3660	2.4448	2.3660	2.4448	2.4448	2.3660	2.4448	2.3660	2.4448	(231)
Lighting	26.2593	21.0662	18.9678	13.8966	10.7341	8.7699	9.7920	12.7281	16.5325	21.6915	24.5005	26.9892	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												768.3018	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.7140	
Water heating fuel used	1394.6919	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.7860	(230a)
Total electricity for the above, kWh/year	28.7860	(231)
Electricity for lighting (calculated in Appendix L)	211.9278	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2403.7075	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	614.6415	0.1645	101.1263	(261)
Space heating - main system 1 (low-rate cost)	153.6604	0.1381	21.2242	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.2843	0.1479	144.4128	(264)
Water heating - low rate cost	418.4076	0.1241	51.9438	(264)
Space and water heating			318.7071	(265)
Pumps, fans and electric keep-hot	28.7860	0.1432	3.9943	(267)
Energy for lighting	211.9278	0.1490	31.5814	(268)
Total CO2, kg/year			354.2828	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.5100	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	614.6415	1.2905	991.5085	(275)
Space heating - main system 1 (low-rate cost)	153.6604	1.5003	230.5366	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	976.2843	1.5529	1516.1005	(278)
Water heating - low rate cost	418.4076	1.4443	604.2958	(278)
Space and water heating			3342.4414	(279)
Pumps, fans and electric keep-hot	28.7860	1.5335	43.5519	(281)
Energy for lighting	211.9278	1.5547	329.4936	(282)
Total Primary energy kWh/year			3715.4870	(286)
Dwelling Primary energy Rate (DPER)			47.2900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b) x	2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c) x	2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1527	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4027	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3423	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4365	0.4279	0.4194	0.3766	0.3680	0.3252	0.3252	0.3167	0.3423	0.3680	0.3851	0.4022 (22b)
Effective ac	0.5953	0.5916	0.5879	0.5709	0.5677	0.5529	0.5529	0.5501	0.5586	0.5677	0.5742	0.5809 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.6700	1.1450	20.2328			(27)
Heatloss Floor 1			39.2800	0.1300	5.1064			(28a)
External Wall 1	89.3500	19.6300	69.7200	0.1800	12.5496			(29a)
External Roof 1	39.2800		39.2800	0.1100	4.3208			(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.1696			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 162.1696 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	7.9100	0.0600	0.4746
E12 Gable (insulation at ceiling level)	8.4000	0.0600	0.5040
P1 Party wall - Ground floor	8.4000	0.0800	0.6720
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.1200	1.0080
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0500	0.6415
E4 Jamb	46.2000	0.0500	2.3100
E5 Ground floor (normal)	17.8700	0.1600	2.8592
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6573 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 54.8269 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.5798	38.3401	38.1051	37.0014	36.7948	35.8335	35.8335	35.6555	36.2038	36.7948	37.2126	37.6494	(38)
Heat transfer coeff	93.4067	93.1670	92.9320	91.8283	91.6218	90.6604	90.6604	90.4824	91.0307	91.6218	92.0395	92.4763	(39)
Average = Sum(39)m / 12 =												91.8273	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1890	1.1859	1.1829	1.1689	1.1663	1.1540	1.1540	1.1518	1.1587	1.1663	1.1716	1.1771	(40)
HLP (average)												1.1689	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4350 (42)

Hot water usage for mixer showers	65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969 (42a)
Hot water usage for baths	28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002 (42b)
Hot water usage for other uses	39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665 (42c)
Average daily hot water use (litres/day)												121.9886 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)
Energy content (annual)											Total = Sum(45)m =	2026.2055	
Distribution loss (46)m = 0.15 x (45)m	31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	261.9234	231.6782	246.0548	215.9612	209.1362	188.2044	185.4746	192.9130	195.1296	217.8989	232.1094	258.9961 (62)
WWHRS	-29.7364	-26.2991	-27.5389	-22.8033	-21.2519	-18.1854	-17.0459	-18.1266	-18.8153	-22.1811	-25.1285	-29.1857 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	232.1870	205.3791	218.5159	193.1579	187.8843	170.0190	168.4287	174.7864	176.3144	195.7178	206.9809	229.8104 (64)
										Total per year (kWh/year) = Sum(64)m =		2359.1818 (64)
12Total per year (kWh/year)												2359 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	111.2811	98.8834	106.0048	95.2182	93.7293	85.9891	85.8618	88.3351	88.2918	96.6429	100.5875	110.3077 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

109.1363	120.8295	109.1363	112.7742	109.1363	112.7742	109.1363	109.1363	112.7742	109.1363	112.7742	109.1363	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

216.4046	218.6502	212.9914	200.9444	185.7372	171.4446	161.8962	159.6506	165.3095	177.3565	192.5637	206.8563	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	(69)
Pumps, fans 3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)

Water heating gains (Table 5)

149.5713	147.1479	142.4795	132.2476	125.9803	119.4293	115.4057	118.7300	122.6275	129.8964	139.7049	148.2631	(72)

Total internal gains

537.6368	549.1522	527.1318	508.4907	483.3783	463.1726	445.9628	447.0414	460.2357	478.9138	507.5673	526.7802	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	7.0700	19.6403	0.6300	0.7000	0.7700	42.4364	(80)

Solar gains	106.0610	207.4778	341.6864	498.3292	610.7212	625.1818	595.1986	511.2668	397.3954	246.1899	132.2456	87.2194	(83)
Total gains	643.6978	756.6300	868.8182	1006.8199	1094.0995	1088.3544	1041.1613	958.3082	857.6311	725.1036	639.8129	613.9996	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.8870	37.9845	38.0805	38.5382	38.6251	39.0347	39.0347	39.1115	38.8759	38.6251	38.4498	38.2682	
alpha	3.5258	3.5323	3.5387	3.5692	3.5750	3.6023	3.6023	3.6074	3.5917	3.5750	3.5633	3.5512	
util living area	0.9736	0.9537	0.9130	0.8179	0.6754	0.5058	0.3756	0.4219	0.6482	0.8738	0.9558	0.9773	(86)
MIT	19.2542	19.5427	19.9614	20.4592	20.7871	20.9439	20.9852	20.9776	20.8639	20.3993	19.7452	19.2108	(87)
Th 2	19.9288	19.9313	19.9337	19.9450	19.9471	19.9570	19.9570	19.9588	19.9531	19.9471	19.9428	19.9383	(88)
util rest of house	0.9681	0.9443	0.8955	0.7840	0.6209	0.4324	0.2898	0.3316	0.5733	0.8413	0.9452	0.9725	(89)
MIT 2	17.9202	18.2834	18.8028	19.4024	19.7630	19.9205	19.9507	19.9486	19.8536	19.3523	18.5509	17.8717	(90)
Living area fraction									fLA = Living area / (4) =			0.2571	(91)
MIT	18.2632	18.6072	19.1007	19.6741	20.0263	20.1836	20.2167	20.2132	20.1134	19.6215	18.8580	18.2160	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2632	18.6072	19.1007	19.6741	20.0263	20.1836	20.2167	20.2132	20.1134	19.6215	18.8580	18.2160	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9562	0.9293	0.8791	0.7743	0.6253	0.4489	0.3116	0.3542	0.5855	0.8295	0.9309	0.9617	(94)
Useful gains	615.5086	703.1044	763.7365	779.5443	684.1111	488.5090	324.3765	339.4334	502.1741	601.4608	595.5970	590.4598	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1304.2578	1277.0598	1171.0092	989.3673	762.8691	506.2125	327.8922	345.0244	547.4056	826.5698	1082.1973	1296.1501	(97)
Space heating kWh	512.4294	385.6980	303.0109	151.0726	58.5959	0.0000	0.0000	0.0000	0.0000	167.4811	350.3522	525.0336	(98a)
Space heating requirement - total per year (kWh/year)												2453.6737	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	512.4294	385.6980	303.0109	151.0726	58.5959	0.0000	0.0000	0.0000	0.0000	167.4811	350.3522	525.0336	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2453.6737	
Space heating per m2										(98c) / (4) =		31.2331	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	512.4294	385.6980	303.0109	151.0726	58.5959	0.0000	0.0000	0.0000	0.0000	167.4811	350.3522	525.0336	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	555.1781	417.8743	328.2892	163.6756	63.4842	0.0000	0.0000	0.0000	0.0000	181.4530	379.5799	568.8338	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	232.1870	205.3791	218.5159	193.1579	187.8843	170.0190	168.4287	174.7864	176.3144	195.7178	206.9809	229.8104	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.7832	85.4513	84.7931	83.5147	81.7702	79.8000	79.8000	79.8000	79.8000	83.7124	85.2302	85.8522	(217)
Fuel for water heating, kWh/month	270.6673	240.3462	257.7048	231.2859	229.7712	213.0564	211.0636	219.0306	220.9453	233.7979	242.8494	267.6816	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	22.6764	18.1918	16.3797	12.0005	9.2695	7.5733	8.4560	10.9914	14.2767	18.7318	21.1576	23.3066	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.6311	-51.5855	-74.0762	-83.2120	-89.6710	-83.6783	-82.6335	-78.0255	-69.9020	-58.9323	-40.2463	-31.6756	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.8826	-43.9060	-87.2229	-130.9437	-173.0865	-173.8937	-171.8572	-145.5477	-106.7239	-62.7837	-27.8792	-16.5163	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	2658.3680	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	2838.2001	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	183.0113	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1941.5124	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	3824.0670	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2658.3680	0.2100	558.2573	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2838.2001	0.2100	596.0220	(264)
Space and water heating			1154.2793	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	183.0113	0.1443	26.4142	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.2692	0.1346	-105.0298	
PV Unit electricity exported	-1161.2432	0.1259	-146.2103	
Total			-251.2401	(269)
Total CO2, kg/year			941.3827	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9800	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2658.3680	1.1300	3003.9559	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2838.2001	1.1300	3207.1661	(278)
Space and water heating			6211.1220	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	183.0113	1.5338	280.7088	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.2692	1.4975	-1168.4424	
PV Unit electricity exported	-1161.2432	0.4622	-536.6928	
Total			-1705.1353	(283)
Total Primary energy kWh/year			4916.7963	(286)
Target Primary Energy Rate (TPER)			62.5900	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b) x	2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c) x	2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1527	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3527	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2998	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3823	0.3748	0.3673	0.3298	0.3223	0.2848	0.2848	0.2773	0.2998	0.3223	0.3373	0.3523	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5731	0.5702	0.5675	0.5544	0.5519	0.5406	0.5406	0.5385	0.5450	0.5519	0.5569	0.5621	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12740.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	162.1696	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3188	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 53.4060	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.1421	36.9581	36.7779	35.9312	35.7728	35.0353	35.0353	34.8988	35.3194	35.7728	36.0932	36.4283	(38)
Heat transfer coeff	90.5481	90.3641	90.1839	89.3372	89.1788	88.4413	88.4413	88.3048	88.7254	89.1788	89.4992	89.8343	(39)
Average = Sum(39)m / 12 =												89.3364	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1526	1.1503	1.1480	1.1372	1.1352	1.1258	1.1258	1.1240	1.1294	1.1352	1.1392	1.1435	(40)
HLP (average)												1.1372	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4350 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)

Hot water usage for other uses

39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)

Average daily hot water use (litres/day)	62.0182 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	67.6617	65.8057	63.7793	61.2572	59.0071	56.6688	56.1830	58.2052	60.2793	62.6806	65.2251	67.5667	(44)
Energy conte	107.1596	93.7064	98.0265	83.8580	79.4350	69.6809	67.9484	72.0702	74.3304	85.0570	92.9251	105.7932	(45)
Energy content (annual)										Total = Sum(45)m =		1029.9906	

Distribution loss (46)m = 0.15 x (45)m

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)

If cylinder contains dedicated solar storage

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	91.0857	79.6505	83.3225	71.2793	67.5197	59.2288	57.7561	61.2597	63.1808	72.2984	78.9863	89.9242	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	91.0857	79.6505	83.3225	71.2793	67.5197	59.2288	57.7561	61.2597	63.1808	72.2984	78.9863	89.9242	(64)
											Total per year (kWh/year) = Sum(64)m =	875.4920	(64)
12Total per year (kWh/year)												875	(64)
Electric shower(s)													
	52.0911	46.4136	50.6819	48.3651	49.2727	47.0013	48.5681	49.2727	48.3651	50.6819	49.7289	52.0911	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	592.5335	(64a)
Heat gains from water heating, kWh/month													
	35.7942	31.5160	33.5011	29.9111	29.1981	26.5575	26.5811	27.6331	27.8865	30.7451	32.1788	35.5038	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	109.1513	120.8461	109.1513	112.7897	109.1513	112.7897	109.1513	109.1513	112.7897	109.1513	112.7897	109.1513	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	216.4046	218.6502	212.9914	200.9444	185.7372	171.4446	161.8962	159.6506	165.3095	177.3565	192.5637	206.8563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)													
	48.1105	46.8988	45.0284	41.5432	39.2447	36.8855	35.7272	37.1412	38.7312	41.3240	44.6928	47.7202	(72)
Total internal gains													
	433.1910	445.9197	426.6956	414.8018	393.6578	380.6443	366.2993	365.4677	376.3549	387.3564	409.5707	423.2523	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	19.6403	0.3900	0.0000	0.7700	86.8181	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	144.7362	283.1347	466.2826	680.0453	833.4211	853.1548	812.2382	697.7006	542.3059	335.9632	180.4690	119.0240	(83)
Total gains	577.9272	729.0544	892.9782	1094.8471	1227.0789	1233.7991	1178.5374	1063.1683	918.6608	723.3196	590.0397	542.2764	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.0831	39.1627	39.2409	39.6128	39.6832	40.0141	40.0141	40.0760	39.8860	39.6832	39.5411	39.3936	
alpha	3.6055	3.6108	3.6161	3.6409	3.6455	3.6676	3.6676	3.6717	3.6591	3.6455	3.6361	3.6262	
util living area													
	0.9805	0.9571	0.9036	0.7795	0.6132	0.4441	0.3264	0.3751	0.6071	0.8702	0.9640	0.9842	(86)
MIT	19.2149	19.5697	20.0534	20.5687	20.8541	20.9657	20.9914	20.9859	20.8965	20.4348	19.7208	19.1540	(87)
Th 2	19.9581	19.9600	19.9619	19.9706	19.9722	19.9798	19.9798	19.9812	19.9769	19.9722	19.9689	19.9655	(88)
util rest of house													
	0.9763	0.9483	0.8851	0.7430	0.5598	0.3784	0.2524	0.2950	0.5343	0.8375	0.9551	0.9808	(89)
MIT 2	18.3466	18.6953	19.1610	19.6379	19.8759	19.9628	19.9771	19.9763	19.9188	19.5361	18.8547	18.2918	(90)
Living area fraction										fLA = Living area / (4) =		0.2571	(91)
MIT	18.5699	18.9201	19.3904	19.8772	20.1274	20.2206	20.2379	20.2359	20.1702	19.7671	19.0774	18.5135	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5699	18.9201	19.3904	19.8772	20.1274	20.2206	20.2379	20.2359	20.1702	19.7671	19.0774	18.5135	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9689	0.9374	0.8731	0.7394	0.5682	0.3942	0.2713	0.3153	0.5488	0.8300	0.9453	0.9743	(94)
Useful gains	559.9250	683.3973	779.6853	809.5298	697.2150	486.3624	319.7345	335.2496	504.1411	600.3438	557.7541	528.3223	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1292.1075	1266.9153	1162.5107	980.6725	751.5462	497.0971	321.7395	338.7281	538.5840	817.5145	1071.9656	1285.8464	(97)
Space heating kWh													
	544.7438	392.1241	284.8221	123.2227	40.4224	0.0000	0.0000	0.0000	0.0000	161.5750	370.2323	563.5979	(98a)
Space heating requirement - total per year (kWh/year)												2480.7404	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	544.7438	392.1241	284.8221	123.2227	40.4224	0.0000	0.0000	0.0000	0.0000	161.5750	370.2323	563.5979	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2480.7404	
Space heating per m2											(98c) / (4) =	31.5777	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W												

	0.0000	0.0000	0.0000	0.0000	0.0000	831.3484	654.4658	671.1162	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9342	0.9615	0.9448	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	776.6401	629.2867	634.0460	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1400.2613	1337.7963	1205.0777	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	449.0073	527.1311	424.8476	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	112.2518	131.7828	106.2119	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												350.2465	(107)
Energy for space heating												31.5777	(99)
Energy for space cooling												4.4583	(108)
Total												36.0360	(109)
Fabric Energy Efficiency (DFEE)												36.0	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b) x	2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c) x	2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1527	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4027	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3423	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4365	0.4279	0.4194	0.3766	0.3680	0.3252	0.3252	0.3167	0.3423	0.3680	0.3851	0.4022	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5953	0.5916	0.5879	0.5709	0.5677	0.5529	0.5529	0.5501	0.5586	0.5677	0.5742	0.5809	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			17.6700	1.1450	20.2328			(27)
Heatloss Floor 1			39.2800	0.1300	5.1064			(28a)
External Wall 1	89.3500	19.6300	69.7200	0.1800	12.5496			(29a)
External Roof 1	39.2800		39.2800	0.1100	4.3208			(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.1696			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	162.1696 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	7.9100	0.0600	0.4746
E12 Gable (insulation at ceiling level)	8.4000	0.0600	0.5040
P1 Party wall - Ground floor	8.4000	0.0800	0.6720
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.1200	1.0080
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0500	0.6415
E4 Jamb	46.2000	0.0500	2.3100
E5 Ground floor (normal)	17.8700	0.1600	2.8592
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000

E18 Party wall between dwellings 10.0000 0.0600 0.6000
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.6573 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 54.8269 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.5798	38.3401	38.1051	37.0014	36.7948	35.8335	35.8335	35.6555	36.2038	36.7948	37.2126	37.6494	(38)
Heat transfer coeff	93.4067	93.1670	92.9320	91.8283	91.6218	90.6604	90.6604	90.4824	91.0307	91.6218	92.0395	92.4763	(39)

Average = Sum(39)m / 12 = 91.8273

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1890	1.1859	1.1829	1.1689	1.1663	1.1540	1.1540	1.1518	1.1587	1.1663	1.1716	1.1771	(40)
HLP (average)												1.1689	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4350 (42)

Hot water usage for mixer showers

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)
Hot water usage for other uses	39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)

Average daily hot water use (litres/day) 62.0182 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	67.6617	65.8057	63.7793	61.2572	59.0071	56.6688	56.1830	58.2052	60.2793	62.6806	65.2251	67.5667	(44)
Energy conte	107.1596	93.7064	98.0265	83.8580	79.4350	69.6809	67.9484	72.0702	74.3304	85.0570	92.9251	105.7932	(45)

Energy content (annual) Total = Sum(45)m = 1029.9906

Distribution loss (46)m = 0.15 x (45)m

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	91.0857	79.6505	83.3225	71.2793	67.5197	59.2288	57.7561	61.2597	63.1808	72.2984	78.9863	89.9242	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	91.0857	79.6505	83.3225	71.2793	67.5197	59.2288	57.7561	61.2597	63.1808	72.2984	78.9863	89.9242	(64)

Total per year (kWh/year) = Sum(64)m = 875.4920 (64)

12Total per year (kWh/year) 875 (64)

Electric shower(s)

	52.0911	46.4136	50.6819	48.3651	49.2727	47.0013	48.5681	49.2727	48.3651	50.6819	49.7289	52.0911	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 592.5335 (64a)

Heat gains from water heating, kWh/month

	35.7942	31.5160	33.5011	29.9111	29.1981	26.5575	26.5811	27.6331	27.8865	30.7451	32.1788	35.5038	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	121.7485	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	109.1363	120.8295	109.1363	112.7742	109.1363	112.7742	109.1363	109.1363	112.7742	109.1363	112.7742	109.1363	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.4046	218.6502	212.9914	200.9444	185.7372	171.4446	161.8962	159.6506	165.3095	177.3565	192.5637	206.8563	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	35.1749	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)	48.1105	46.8988	45.0284	41.5432	39.2447	36.8855	35.7272	37.1412	38.7312	41.3240	44.6928	47.7202	(72)
Total internal gains	433.1760	445.9031	426.6806	414.7863	393.6428	380.6288	366.2843	365.4527	376.3394	387.3414	409.5552	423.2374	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	10.6000	19.6403	0.6300	0.7000	0.7700	63.6246	(76)
West	7.0700	19.6403	0.6300	0.7000	0.7700	42.4364	(80)

Solar gains	106.0610	207.4778	341.6864	498.3292	610.7212	625.1818	595.1986	511.2668	397.3954	246.1899	132.2456	87.2194	(83)
Total gains	539.2370	653.3809	768.3670	913.1155	1004.3640	1005.8106	961.4829	876.7195	773.7348	633.5313	541.8008	510.4568	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.8870	37.9845	38.0805	38.5382	38.6251	39.0347	39.0347	39.1115	38.8759	38.6251	38.4498	38.2682	
alpha	3.5258	3.5323	3.5387	3.5692	3.5750	3.6023	3.6023	3.6074	3.5917	3.5750	3.5633	3.5512	
util living area													

	0.9844	0.9693	0.9361	0.8506	0.7132	0.5403	0.4045	0.4572	0.6945	0.9079	0.9725	0.9870	(86)
MIT	19.0748	19.3774	19.8229	20.3712	20.7446	20.9306	20.9812	20.9710	20.8290	20.2894	19.5861	19.0302	(87)
Th 2	19.9288	19.9313	19.9337	19.9450	19.9471	19.9570	19.9570	19.9588	19.9531	19.9471	19.9428	19.9383	(88)
util rest of house													
	0.9810	0.9627	0.9224	0.8202	0.6598	0.4641	0.3131	0.3610	0.6201	0.8816	0.9654	0.9841	(89)
MIT 2	18.1873	18.4870	18.9225	19.4461	19.7722	19.9213	19.9507	19.9483	19.8532	19.3866	18.7046	18.1500	(90)
Living area fraction										fLA = Living area / (4) =		0.2571	(91)
MIT	18.4155	18.7160	19.1540	19.6840	20.0222	20.1808	20.2157	20.2113	20.1041	19.6187	18.9312	18.3764	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4155	18.7160	19.1540	19.6840	20.0222	20.1808	20.2157	20.2113	20.1041	19.6187	18.9312	18.3764	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9743	0.9529	0.9101	0.8117	0.6639	0.4811	0.3362	0.3850	0.6317	0.8717	0.9564	0.9783	(94)
Useful gains	525.3698	622.6284	699.2862	741.1476	666.7871	483.8640	323.2874	337.5293	488.8034	552.2469	518.1957	499.3648	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1318.4848	1287.1912	1175.9644	990.2755	762.4984	505.9589	327.7969	344.8522	546.5595	826.3128	1088.9413	1310.9761	(97)
Space heating kWh													
	590.0776	446.5862	354.6486	179.3721	71.2092	0.0000	0.0000	0.0000	0.0000	203.9050	410.9368	603.8388	(98a)
Space heating requirement - total per year (kWh/year)												2860.5744	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	590.0776	446.5862	354.6486	179.3721	71.2092	0.0000	0.0000	0.0000	0.0000	203.9050	410.9368	603.8388	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2860.5744	
Space heating per m2											(98c) / (4) =	36.4126	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	852.2082	670.8873	687.6664	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8786	0.9240	0.8985	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	748.7143	619.8974	617.8467	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1133.7980	1084.1122	987.1662	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	277.2603	345.3758	274.7737	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	69.3151	86.3439	68.6934	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												224.3525	(107)
Energy for space heating												36.4126	(99)
Energy for space cooling												2.8558	(108)
Total												39.2684	(109)
Fabric Energy Efficiency (TFEE)												39.3	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b)	x 2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c)	x 2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 12740.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 162.1696 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.3188 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 53.4060 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	(38)
Heat transfer coeff	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	(39)

Average = Sum(39)m / 12 = 85.8120

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	(40)
HLP (average)												1.0923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4350 (42)
Hot water usage for mixer showers

65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969	(42a)

Hot water usage for baths

28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)

Hot water usage for other uses

39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)

Average daily hot water use (litres/day) 121.9886 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)

Energy content (annual) Total = Sum(45)m = 2026.2055
Distribution loss (46)m = 0.15 x (45)m

31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(64)

Total per year (kWh/year) = Sum(64)m = 2562.2445 (64)
Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	106.3051	94.3890	101.0288	90.4028	88.7533	81.1736	80.8858	83.3591	83.4763	91.6669	95.7721	105.3317 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	30.0006	26.6462	21.6702	16.4057	12.2635	10.3533	11.1871	14.5415	19.5175	24.7820	28.9242	30.8344	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	322.9920	326.3436	317.8976	299.9170	277.2197	255.8874	241.6362	238.2845	246.7305	264.7112	287.4085	308.7407	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)

Water heating gains (Table 5)

	142.8832	140.4598	135.7914	125.5594	119.2921	112.7412	108.7175	112.0418	115.9393	123.2082	133.0168	141.5749	(72)

Total internal gains

	596.6199	594.1938	576.1033	542.6263	509.5194	479.7261	462.2850	465.6120	482.9316	513.4456	550.0937	581.8942	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	19.6403	0.3900	0.0000	0.7700	86.8181	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	144.7362	283.1347	466.2826	680.0453	833.4211	853.1548	812.2382	697.7006	542.3059	335.9632	180.4690	119.0240	(83)
Total gains	741.3561	877.3286	1042.3859	1222.6717	1342.9406	1332.8809	1274.5232	1163.3125	1025.2375	849.4088	730.5627	700.9183	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	
alpha	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	
util living area	0.9574	0.9248	0.8531	0.7207	0.5568	0.4032	0.2941	0.3354	0.5439	0.8085	0.9317	0.9644	(86)
Living	19.6133	19.9068	20.3194	20.6988	20.9037	20.9774	20.9947	20.9913	20.9339	20.6056	20.0182	19.5322	
Non living	18.4224	18.7849	19.2820	19.7142	19.9266	19.9928	20.0049	20.0032	19.9605	19.6279	18.9304	18.3212	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2906	19.9068	20.3194	20.6988	20.9037	20.9774	20.9947	20.9913	20.9339	20.6056	20.0182	19.7375	(87)
Th 2	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	(88)
util rest of house	0.9492	0.9113	0.8292	0.6821	0.5064	0.3437	0.2287	0.2647	0.4760	0.7689	0.9170	0.9575	(89)
MIT 2	19.3754	18.7849	19.2820	19.7142	19.9266	19.9928	20.0049	20.0032	19.9605	19.6279	18.9304	18.6250	(90)
Living area fraction									fLA = Living area / (4) =			0.2571	(91)
MIT	19.6107	19.0734	19.5487	19.9673	20.1778	20.2460	20.2594	20.2573	20.2108	19.8793	19.2101	18.9111	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6107	19.0734	19.5487	19.9673	20.1778	20.2460	20.2594	20.2573	20.2108	19.8793	19.2101	18.9111	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9454	0.8961	0.8167	0.6805	0.5154	0.3582	0.2454	0.2827	0.4904	0.7632	0.9025	0.9478	(94)
Useful gains	700.8855	786.1676	851.3479	832.0366	692.0915	477.4954	312.7792	328.8670	502.7448	648.2935	659.3070	664.3458	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1313.8420	1216.2472	1119.7366	949.7104	727.4984	484.4905	314.0198	330.9994	524.3808	796.2783	1039.1934	1262.3868	(97)
Space heating kWh	456.0397	289.0135	199.6812	84.7251	26.3427	0.0000	0.0000	0.0000	0.0000	110.1007	273.5182	444.9426	(98a)
Space heating requirement - total per year (kWh/year)												1884.3636	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	456.0397	289.0135	199.6812	84.7251	26.3427	0.0000	0.0000	0.0000	0.0000	110.1007	273.5182	444.9426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1884.3636	
Space heating per m2											(98c) / (4) =	23.9863	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	264.6986	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	456.0397	289.0135	199.6812	84.7251	26.3427	0.0000	0.0000	0.0000	0.0000	110.1007	273.5182	444.9426	(98)
Space heating efficiency (main heating system 1)	264.6986	264.6986	264.6986	264.6986	264.6986	0.0000	0.0000	0.0000	0.0000	264.6986	264.6986	264.6986	(210)
Space heating fuel (main heating system)	172.2864	109.1859	75.4372	32.0081	9.9520	0.0000	0.0000	0.0000	0.0000	41.5947	103.3320	168.0941	(211)
Space heating efficiency (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
	255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761 (64)
Efficiency of water heater												183.7140 (216)
(217)m	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140 (217)
Fuel for water heating, kWh/month												
	139.1856	123.0500	130.5479	114.2764	110.4522	99.1677	97.5726	101.6215	102.9373	115.2220	123.0663	137.5922 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	2.4448	2.2082	2.4448	2.3660	2.4448	2.3660	2.4448	2.4448	2.3660	2.4448	2.3660	2.4448 (231)
Lighting	26.2593	21.0662	18.9678	13.8966	10.7341	8.7699	9.7920	12.7281	16.5325	21.6915	24.5005	26.9892 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year	
Space heating fuel - main system 1	711.8904 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	183.7140
Water heating fuel used	1394.6919 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)	
mechanical ventilation fans (SFP = 0.1201)	28.7860 (230a)
Total electricity for the above, kWh/year	28.7860 (231)
Electricity for lighting (calculated in Appendix L)	211.9278 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	2347.2961 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	569.5123	17.5600	111.6244	(240)
Space heating - main system 1 (low-rate cost)	142.3781	0.0940	13.3835	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	976.2843	19.6000	191.3517	(245)
Low-rate cost	418.4076	9.4000	39.3303	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	28.7860	18.5800	4.7906	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	211.9278	18.5800	39.3762	(250)
Additional standing charges			7.0000	(251)
Total energy cost			406.8567	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1854 (257)
SAP value		80.7846
SAP rating (Section 12)		81 (258)
SAP band		B

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	569.5123	0.1646	93.7142	(261)
Space heating - main system 1 (low-rate cost)	142.3781	0.1381	19.6687	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.2843	0.1479	144.4128	(264)
Water heating - low rate cost	418.4076	0.1241	51.9438	(264)
Space and water heating			309.7396	(265)
Pumps, fans and electric keep-hot	28.7860	0.1432	3.9943	(267)
Energy for lighting	211.9278	0.1490	31.5814	(268)
Total CO2, kg/year			345.3153	(272)
CO2 emissions per m2			4.4000	(273)
EI value			96.2551	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b) x	2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c) x	2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

2. Ventilation rate

	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	0 * 10 =	0.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12740.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							162.1696	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		14.3188 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	53.4060 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	(38)
Heat transfer coeff	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	(39)
Average = Sum(39)m / 12 =												85.8120	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	(40)
HLP (average)												1.0923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4350 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969	(42a)

Hot water usage for baths

28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)

Hot water usage for other uses

39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)

Average daily hot water use (litres/day) 121.9886 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)
Energy content (annual)										Total = Sum(45)m =		2026.2055	
Distribution loss (46)m = 0.15 x (45)m													
	31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(64)
										Total per year (kWh/year) = Sum(64)m =		2562.2445	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.3051	94.3890	101.0288	90.4028	88.7533	81.1736	80.8858	83.3591	83.4763	91.6669	95.7721	105.3317	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.0006	26.6462	21.6702	16.4057	12.2635	10.3533	11.1871	14.5415	19.5175	24.7820	28.9242	30.8344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.9920	326.3436	317.8976	299.9170	277.2197	255.8874	241.6362	238.2845	246.7305	264.7112	287.4085	308.7407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)													
	142.8832	140.4598	135.7914	125.5594	119.2921	112.7412	108.7175	112.0418	115.9393	123.2082	133.0168	141.5749	(72)
Total internal gains													
	596.6199	594.1938	576.1033	542.6263	509.5194	479.7261	462.2850	465.6120	482.9316	513.4456	550.0937	581.8942	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	26.6540	0.3900	0.0000	0.7700	117.8219	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	196.4232	324.1390	525.4848	782.7400	923.2340	1009.9347	965.7928	833.9793	654.7409	409.9093	235.9147	161.0608	(83)
Total gains	793.0432	918.3328	1101.5881	1325.3663	1432.7534	1489.6609	1428.0778	1299.5912	1137.6725	923.3549	786.0084	742.9550	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	
alpha	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	
util living area													
	0.9386	0.9037	0.8116	0.6447	0.4628	0.2973	0.1979	0.2173	0.4194	0.7140	0.8921	0.9469	(86)
Living	19.8442	20.0740	20.4766	20.8120	20.9552	20.9935	20.9990	20.9986	20.9770	20.7832	20.2878	19.7988	
Non living	18.7107	18.9898	19.4656	19.8336	19.9735	20.0038	20.0069	20.0068	19.9938	19.8178	19.2581	18.6559	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4088	20.0740	20.4766	20.8120	20.9552	20.9935	20.9990	20.9986	20.9770	20.7832	20.2878	19.9668	(87)
Th 2	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	(88)

util rest of house	0.9269	0.8866	0.7822	0.6012	0.4101	0.2414	0.1386	0.1522	0.3503	0.6608	0.8689	0.9363	(89)
MIT 2	19.4903	18.9898	19.4656	19.8336	19.9735	20.0038	20.0069	20.0068	19.9938	19.8178	19.2581	18.8994	(90)
Living area fraction										fLA = Living area / (4) =		0.2571	(91)
MIT	19.7264	19.2686	19.7256	20.0851	20.2259	20.2583	20.2620	20.2618	20.2466	20.0660	19.5229	19.1739	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7264	19.2686	19.7256	20.0851	20.2259	20.2583	20.2620	20.2618	20.2466	20.0660	19.5229	19.1739	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9230	0.8717	0.7731	0.6047	0.4220	0.2556	0.1538	0.1690	0.3673	0.6642	0.8557	0.9254	(94)
Useful gains	732.0146	800.4684	851.6368	801.4886	604.5575	380.8313	219.6805	219.5988	417.8154	613.2662	672.5716	687.5066	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1237.9612	1164.3478	1057.6815	874.0072	620.0687	382.5730	219.8475	219.8323	424.4798	692.1620	945.8964	1173.3830	(97)
Space heating kWh	376.4242	244.5270	153.2973	52.2134	11.5404	0.0000	0.0000	0.0000	0.0000	58.6985	196.7939	361.4921	(98a)
Space heating requirement - total per year (kWh/year)												1454.9866	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	376.4242	244.5270	153.2973	52.2134	11.5404	0.0000	0.0000	0.0000	0.0000	58.6985	196.7939	361.4921	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1454.9866	
Space heating per m2											(98c) / (4) =	18.5207	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												264.6986	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	376.4242	244.5270	153.2973	52.2134	11.5404	0.0000	0.0000	0.0000	0.0000	58.6985	196.7939	361.4921	(98)
Space heating efficiency (main heating system 1)	264.6986	264.6986	264.6986	264.6986	0.0000	0.0000	0.0000	0.0000	264.6986	264.6986	264.6986		(210)
Space heating fuel (main heating system)	142.2087	92.3794	57.9139	19.7256	4.3598	0.0000	0.0000	0.0000	0.0000	22.1756	74.3464	136.5674	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	255.7034	226.0601	239.8348	209.9418	202.9162	182.1850	179.2546	186.6930	189.1103	211.6790	226.0901	252.7761	(64)
Efficiency of water heater												183.7140	(216)
(217)m	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	(217)
Fuel for water heating, kWh/month	139.1856	123.0500	130.5479	114.2764	110.4522	99.1677	97.5726	101.6215	102.9373	115.2220	123.0663	137.5922	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	2.4448	2.2082	2.4448	2.3660	2.4448	2.3660	2.4448	2.4448	2.3660	2.4448	2.3660	2.4448	(231)
Lighting	26.2593	21.0662	18.9678	13.8966	10.7341	8.7699	9.7920	12.7281	16.5325	21.6915	24.5005	26.9892	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	549.6768	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.7140	
Water heating fuel used	1394.6919	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.7860	(230a)
Total electricity for the above, kWh/year	28.7860	(231)
Electricity for lighting (calculated in Appendix L)	211.9278	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2185.0825	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	439.7415	27.8600	137.1993	(240)
Space heating - main system 1 (low-rate cost)	109.9354	0.1450	15.9406	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	976.2843	31.2000	304.6007	(245)
Low-rate cost	418.4076	14.5000	60.6691	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	28.7860	29.5300	7.5871	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	211.9278	29.5300	62.5823	(250)
Additional standing charges			3.0000	(251)
Total energy cost			591.5792	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	439.7415	0.1655	72.7943	(261)
Space heating - main system 1 (low-rate cost)	109.9354	0.1390	15.2771	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	976.2843	0.1479	144.4128	(264)
Water heating - low rate cost	418.4076	0.1241	51.9438	(264)
Space and water heating			284.4281	(265)
Pumps, fans and electric keep-hot	28.7860	0.1432	3.9943	(267)
Energy for lighting	211.9278	0.1490	31.5814	(268)
Total CO2, kg/year			320.0038	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	439.7415	1.2934	710.9580	(275)
Space heating - main system 1 (low-rate cost)	109.9354	1.5036	165.3042	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	976.2843	1.5529	1516.1005	(278)
Water heating - low rate cost	418.4076	1.4443	604.2958	(278)
Space and water heating			2996.6585	(279)
Pumps, fans and electric keep-hot	28.7860	1.5335	43.5519	(281)
Energy for lighting	211.9278	1.5547	329.4936	(282)
Total Primary energy kWh/year			3369.7040	(286)

SAP 10 EPC IMPROVEMENTS

3B4P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N Solar water heating — Recommended
U Solar photovoltaic panels — Recommended
V2 Wind turbine — Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.2	-£ 95	-46 kg (14.5%)
U Solar photovoltaic panels	+ 9.5	-£ 326	-265 kg (96.8%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£95	0.59 kg/m²	B 83	A 97
Solar photovoltaic panels	£326	3.37 kg/m²	A 92	A 99
Total Savings	£421	3.96 kg/m²		

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£592	£496	£95
Space heating	£164	£188	-£24
Water heating	£365	£246	£119
Lighting	£63	£63	£0
Generated (PV)	-£0	-£326	£326
Total cost of fuels	£592	£170	£421
Total cost of uses	£592	£171	£421
Delivered energy	28 kWh/m²	-3 kWh/m²	31 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.0 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	0 kg/m²	4 kg/m²
Primary energy	43 kWh/m²	12 kWh/m²	31 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800 (1b)	x	2.4000 (2b)	=	94.2720	(1b) - (3b)
First floor	39.2800 (1c)	x	2.6000 (2c)	=	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	196.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12740.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	162.1696	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3188	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	53.4060	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	(38)
Heat transfer coeff	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	(39)
Average = Sum(39)m / 12 =												85.8120	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	(40)
HLP (average)												1.0923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4350	(42)
Hot water usage for mixer showers													
	65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969	(42a)
Hot water usage for baths													
	28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)
Hot water usage for other uses													
	39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)
Average daily hot water use (litres/day)												121.9886	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)
Energy content (annual)											Total = Sum(45)m =	2026.2055	
Distribution loss (46)m = 0.15 x (45)m													
	31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	255.7034	226.0601	238.4391	203.1882	190.1219	169.5783	166.2277	174.5965	183.7074	210.2832	226.0901	252.7761	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												611.9918	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												611.9918	
Solar input	-0.0000	-16.2225	-57.9101	-79.1562	-102.6737	-94.4239	-93.5964	-82.2437	-57.1567	-28.6086	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	255.7034	209.8376	180.5290	124.0320	87.4482	75.1544	72.6312	92.3528	126.5508	181.6746	226.0901	252.7761	(64)
											Total per year (kWh/year) = Sum(64)m =	1884.7803	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.3051	94.3890	99.9122	84.9999	78.5179	71.0883	70.4643	73.6819	79.1540	90.5503	95.7721	105.3317	(65)

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5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.0006	26.6462	21.6702	16.4057	12.2635	10.3533	11.1871	14.5415	19.5175	24.7820	28.9242	30.8344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.9920	326.3436	317.8976	299.9170	277.2197	255.8874	241.6362	238.2845	246.7305	264.7112	287.4085	308.7407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)													
	142.8832	140.4598	134.2906	118.0554	105.5348	98.7337	94.7101	99.0349	109.9361	121.7074	133.0168	141.5749	(72)
Total internal gains													
	596.6199	594.1938	574.6025	535.1223	495.7621	465.7186	448.2776	452.6050	476.9284	511.9448	550.0937	581.8942	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	19.6403	0.3900	0.0000	0.7700	86.8181	(76)
West	9.8200	19.6403	0.3900	0.0000	0.7700	57.9181	(80)

Solar gains	144.7362	283.1347	466.2826	680.0453	833.4211	853.1548	812.2382	697.7006	542.3059	335.9632	180.4690	119.0240	(83)
Total gains	741.3561	877.3286	1040.8851	1215.1677	1329.1832	1318.8734	1260.5157	1150.3056	1019.2343	847.9080	730.5627	700.9183	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	
alpha	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	
util living area													

	0.9574	0.9248	0.8535	0.7234	0.5615	0.4072	0.2972	0.3390	0.5466	0.8092	0.9317	0.9644	(86)
Living	19.6133	19.9068	20.3178	20.6947	20.9009	20.9766	20.9945	20.9909	20.9328	20.6044	20.0182	19.5322	
Non living	18.4224	18.7849	19.2802	19.7100	19.9242	19.9923	20.0048	20.0031	19.9597	19.6266	18.9304	18.3212	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2906	19.9068	20.3178	20.6947	20.9009	20.9766	20.9945	20.9909	20.9328	20.6044	20.0182	19.7375	(87)
Th 2	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	(88)
util rest of house													
	0.9492	0.9113	0.8297	0.6850	0.5109	0.3472	0.2312	0.2677	0.4784	0.7696	0.9170	0.9575	(89)
MIT 2	19.3754	18.7849	19.2802	19.7100	19.9242	19.9923	20.0048	20.0031	19.9597	19.6266	18.9304	18.6250	(90)
Living area fraction										fLA = Living area / (4) =		0.2571	(91)
MIT	19.6107	19.0734	19.5470	19.9632	20.1753	20.2454	20.2593	20.2571	20.2099	19.8780	19.2101	18.9111	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6107	19.0734	19.5470	19.9632	20.1753	20.2454	20.2593	20.2571	20.2099	19.8780	19.2101	18.9111	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9454	0.8961	0.8172	0.6831	0.5198	0.3618	0.2481	0.2858	0.4928	0.7639	0.9025	0.9478	(94)
Useful gains	700.8855	786.1676	850.6225	830.1414	690.8703	477.2083	312.7216	328.7684	502.3094	647.7226	659.3070	664.3458	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1313.8420	1216.2472	1119.5905	949.3543	727.2847	484.4420	314.0098	330.9825	524.3052	796.1667	1039.1934	1262.3868	(97)
Space heating kWh													
	456.0397	289.0135	200.1122	85.8333	27.0924	0.0000	0.0000	0.0000	0.0000	110.4424	273.5182	444.9426	(98a)
Space heating requirement - total per year (kWh/year)												1886.9942	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	456.0397	289.0135	200.1122	85.8333	27.0924	0.0000	0.0000	0.0000	0.0000	110.4424	273.5182	444.9426	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1886.9942	
Space heating per m2											(98c) / (4) =	24.0198	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	264.6986	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	456.0397	289.0135	200.1122	85.8333	27.0924	0.0000	0.0000	0.0000	0.0000	110.4424	273.5182	444.9426	(98)
Space heating efficiency (main heating system 1)													
	264.6986	264.6986	264.6986	264.6986	264.6986	0.0000	0.0000	0.0000	0.0000	264.6986	264.6986	264.6986	(210)
Space heating fuel (main heating system)													
	172.2864	109.1859	75.6000	32.4268	10.2352	0.0000	0.0000	0.0000	0.0000	41.7238	103.3320	168.0941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	255.7034	209.8376	180.5290	124.0320	87.4482	75.1544	72.6312	92.3528	126.5508	181.6746	226.0901	252.7761	(64)
Efficiency of water heater												183.7140	(216)
(217)m	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	(217)
Fuel for water heating, kWh/month													
	139.1856	114.2197	98.2663	67.5136	47.6002	40.9084	39.5349	50.2699	68.8847	98.8899	123.0663	137.5922	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.2394	8.3452	9.2394	8.9413	9.2394	8.9413	9.2394	9.2394	8.9413	9.2394	8.9413	9.2394	(231)
Lighting	26.2593	21.0662	18.9678	13.8966	10.7341	8.7699	9.7920	12.7281	16.5325	21.6915	24.5005	26.9892	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-36.8055	-53.6239	-78.3462	-87.6614	-92.8284	-85.8329	-84.6516	-80.2268	-71.7384	-60.9199	-40.8190	-31.5110	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-13.2810	-29.9561	-64.0000	-103.1106	-142.8544	-145.8808	-143.9999	-119.5471	-84.7247	-45.9260	-18.5908	-10.4028	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	712.8842	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.7140	
Water heating fuel used	1025.9317	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	28.7860	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	108.7860	(231)
Electricity for lighting (calculated in Appendix L)	211.9278	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	332.2903	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	570.3074	17.5600	111.7802	(240)
Space heating - main system 1 (low-rate cost)	142.5768	0.0940	13.4022	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	718.1522	19.6000	140.7578	(245)
Low-rate cost	307.7795	9.4000	28.9313	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	28.7860	18.5800	4.7906	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	211.9278	18.5800	39.3762	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-804.9651	18.5800	-149.5625	
PV Unit electricity exported	-922.2743	5.5900	-51.5551	
Total			-201.1176	(252)
Total energy cost			159.7847	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4655	(257)
SAP value		92.4535	
SAP rating (Section 12)		92	(258)
SAP band		A	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	570.3074	0.1645	93.8315	(261)
Space heating - main system 1 (low-rate cost)	142.5768	0.1381	19.6934	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	718.1522	0.1531	109.9760	(264)
Water heating - low rate cost	307.7795	0.1285	39.5604	(264)
Space and water heating			263.0612	(265)
Pumps, fans and electric keep-hot	108.7860	0.1432	15.4505	(267)
Energy for lighting	211.9278	0.1490	31.5814	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-804.9651	0.1390	-111.8788	
PV Unit electricity exported	-922.2743	0.1240	-114.3768	
Total			-226.2556	(269)
Total CO2, kg/year			83.8375	(272)
CO2 emissions per m2			1.0700	(273)
EI value			99.0908	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	39.2800	(1b) x	2.4000	(2b) =	94.2720	(1b) - (3b)
First floor	39.2800	(1c) x	2.6000	(2c) =	102.1280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		196.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			24.5400	0.6998	17.1742			(27)
Heatloss Floor 1			39.2800	0.1100	4.3208	75.0000	2946.0000	(28a)
External Wall 1	89.3500	26.5000	62.8500	0.1800	11.3130	60.0000	3771.0000	(29a)
External Roof 1	39.2800		39.2800	0.0900	3.5352	9.0000	353.5200	(30)
Total net area of external elements Aum(A, m2)			167.9100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0872			(33)
Main dwelling								
Party Wall 1			42.0000	0.0000	0.0000	70.0000	2940.0000	(32)
Internal Wall 1			177.2800			9.0000	1595.5200	(32c)
Internal Floor 1			42.0000			18.0000	756.0000	(32d)
Internal Ceiling 1			42.0000			9.0000	378.0000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 12740.0400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	162.1696	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	7.9100	0.0980	0.7752
E12 Gable (insulation at ceiling level)	8.4000	0.0970	0.8148
P1 Party wall - Ground floor	8.4000	0.3200	2.6880
P2 Party wall - Intermediate floor within a dwelling	8.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.4000	0.4800	4.0320
E1 Steel lintel with perforated steel base plate	13.7600	0.0500	0.6880
E3 Sill	12.8300	0.0450	0.5774
E4 Jamb	46.2000	0.0510	2.3562
E5 Ground floor (normal)	17.8700	0.0670	1.1973
E6 Intermediate floor within a dwelling	17.8700	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.3188	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	53.4060	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	32.4060	(38)
Heat transfer coeff													
	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	85.8120	(39)
Average = Sum(39)m / 12 =												85.8120	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	1.0923	(40)
HLP (average)												1.0923	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4350	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	65.0461	64.0686	62.6442	59.9188	57.9075	55.6646	54.3897	55.8033	57.3530	59.7612	62.5451	64.7969	(42a)
Hot water usage for baths													
	28.0952	27.6779	27.0904	26.0070	25.1957	24.2962	23.8103	24.3938	25.0291	25.9916	27.0973	28.0002	(42b)
Hot water usage for other uses													
	39.5665	38.1277	36.6890	35.2502	33.8114	32.3726	32.3726	33.8114	35.2502	36.6890	38.1277	39.5665	(42c)
Average daily hot water use (litres/day)												121.9886	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	132.7079	129.8743	126.4235	121.1760	116.9147	112.3334	110.5726	114.0085	117.6322	122.4418	127.7702	132.3637	(44)
Energy conte	210.1768	184.9393	194.3082	165.8838	157.3896	138.1270	133.7280	141.1664	145.0523	166.1524	182.0321	207.2495	(45)
Energy content (annual)										Total = Sum(45)m =		2026.2055	
Distribution loss (46)m = 0.15 x (45)m													
	31.5265	27.7409	29.1462	24.8826	23.6084	20.7191	20.0592	21.1750	21.7578	24.9229	27.3048	31.0874	(46)

Water storage loss:		
Store volume	210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3300	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7182	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	255.7034	226.0601	238.4391	203.1882	190.1219	169.5783	166.2277	174.5965	183.7074	210.2832	226.0901	252.7761	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												768.4263	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												768.4263	
Solar input	-6.4587	-23.9471	-69.2703	-94.7047	-115.5838	-113.4966	-112.8095	-101.8078	-75.1640	-44.4562	-10.7275	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	249.2448	202.1130	169.1688	108.4835	74.5381	56.0817	53.4181	72.7888	108.5434	165.8270	215.3626	252.7761	(64)
											Total per year (kWh/year) = Sum(64)m =	1728.3458	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	106.3051	94.3890	99.9122	84.9999	78.5179	71.0883	70.4643	73.6819	79.1540	90.5503	95.7721	105.3317	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	146.0982	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	30.0006	26.6462	21.6702	16.4057	12.2635	10.3533	11.1871	14.5415	19.5175	24.7820	28.9242	30.8344	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	322.9920	326.3436	317.8976	299.9170	277.2197	255.8874	241.6362	238.2845	246.7305	264.7112	287.4085	308.7407	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	52.0448	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	-97.3988	(71)
Water heating gains (Table 5)													
	142.8832	140.4598	134.2906	118.0554	105.5348	98.7337	94.7101	99.0349	109.9361	121.7074	133.0168	141.5749	(72)
Total internal gains													
	596.6199	594.1938	574.6025	535.1223	495.7621	465.7186	448.2776	452.6050	476.9284	511.9448	550.0937	581.8942	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	14.7200	26.6540	0.3900	0.0000	0.7700	117.8219	(76)
West	9.8200	26.6540	0.3900	0.0000	0.7700	78.6013	(80)

Solar gains	196.4232	324.1390	525.4848	782.7400	923.2340	1009.9347	965.7928	833.9793	654.7409	409.9093	235.9147	161.0608	(83)
Total gains	793.0432	918.3328	1100.0873	1317.8623	1418.9961	1475.6534	1414.0703	1286.5843	1131.6693	921.8541	786.0084	742.9550	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	41.2402	
alpha	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	3.7493	
util living area													
	0.9386	0.9037	0.8121	0.6473	0.4668	0.3000	0.1999	0.2195	0.4214	0.7147	0.8921	0.9469	(86)
Living	19.8442	20.0740	20.4754	20.8093	20.9539	20.9932	20.9990	20.9985	20.9766	20.7825	20.2878	19.7988	
Non living	18.7107	18.9898	19.4642	19.8310	19.9724	20.0037	20.0069	20.0067	19.9936	19.8170	19.2581	18.6559	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.4088	20.0740	20.4754	20.8093	20.9539	20.9932	20.9990	20.9985	20.9766	20.7825	20.2878	19.9668	(87)
Th 2	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	20.0071	(88)
util rest of house													
	0.9269	0.8866	0.7828	0.6038	0.4138	0.2437	0.1399	0.1538	0.3521	0.6615	0.8689	0.9363	(89)
MIT 2	19.4903	18.9898	19.4642	19.8310	19.9724	20.0037	20.0069	20.0067	19.9936	19.8170	19.2581	18.8994	(90)
Living area fraction											fLA = Living area / (4) =	0.2571	(91)
MIT	19.7264	19.2686	19.7242	20.0826	20.2248	20.2581	20.2620	20.2618	20.2464	20.0653	19.5229	19.1739	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7264	19.2686	19.7242	20.0826	20.2248	20.2581	20.2620	20.2618	20.2464	20.0653	19.5229	19.1739	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9230	0.8717	0.7736	0.6072	0.4257	0.2580	0.1553	0.1707	0.3691	0.6649	0.8557	0.9254	(94)
Useful gains	732.0146	800.4684	851.0393	800.2671	604.0067	380.7629	219.6732	219.5884	417.6803	612.9215	672.5716	687.5066	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W													
	1237.9612	1164.3478	1057.5638	873.7859	619.9748	382.5614	219.8461	219.8304	424.4569	692.0980	945.8964	1173.3830	(97)
Space heating kWh													
	376.4242	244.5270	153.6542	52.9336	11.8803	0.0000	0.0000	0.0000	0.0000	58.9073	196.7939	361.4921	(98a)
Space heating requirement - total per year (kWh/year)												1456.6125	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

376.4242	244.5270	153.6542	52.9336	11.8803	0.0000	0.0000	0.0000	0.0000	58.9073	196.7939	361.4921	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 1456.6125

Space heating per m2 (98c) / (4) = 18.5414 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 264.6986 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	376.4242	244.5270	153.6542	52.9336	11.8803	0.0000	0.0000	0.0000	0.0000	58.9073	196.7939	361.4921	(98)
Space heating efficiency (main heating system 1)													
	264.6986	264.6986	264.6986	264.6986	264.6986	0.0000	0.0000	0.0000	0.0000	264.6986	264.6986	264.6986	(210)
Space heating fuel (main heating system)													
	142.2087	92.3794	58.0488	19.9977	4.4882	0.0000	0.0000	0.0000	0.0000	22.2545	74.3464	136.5674	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	249.2448	202.1130	169.1688	108.4835	74.5381	56.0817	53.4181	72.7888	108.5434	165.8270	215.3626	252.7761	(64)
Efficiency of water heater												183.7140	(216)
(217)m	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	183.7140	(217)
Fuel for water heating, kWh/month													
	135.6700	110.0150	92.0827	59.0502	40.5729	30.5266	29.0768	39.6207	59.0828	90.2637	117.2271	137.5922	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.2394	8.3452	9.2394	8.9413	9.2394	8.9413	9.2394	9.2394	8.9413	9.2394	8.9413	9.2394	(231)
Lighting	26.2593	21.0662	18.9678	13.8966	10.7341	8.7699	9.7920	12.7281	16.5325	21.6915	24.5005	26.9892	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.2313	-58.1362	-83.0136	-92.7608	-95.9191	-91.2462	-90.1039	-86.2657	-78.6310	-67.8127	-49.0361	-39.6527	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.4385	-35.8855	-75.2466	-124.9643	-163.8894	-182.0981	-180.6712	-150.9009	-108.1060	-60.4537	-27.1702	-15.9574	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 550.2911 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.7140

Water heating fuel used 940.7806 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)

mechanical ventilation fans (SFP = 0.1201) 28.7860 (230a)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 108.7860 (231)

Electricity for lighting (calculated in Appendix L) 211.9278 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -2024.5910 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses -212.8055 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	440.2329	27.8600	137.3527	(240)
Space heating - main system 1 (low-rate cost)	110.0582	0.1450	15.9584	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	658.5464	31.2000	205.4665	(245)
Low-rate cost	282.2342	14.5000	40.9240	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	28.7860	29.5300	7.5871	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	211.9278	29.5300	62.5823	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.8092	29.5300	-259.5124	
PV Unit electricity exported	-1145.7818	5.8100	-66.5699	
Total			-326.0823	(252)
Total energy cost			170.4126	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	440.2329	0.1655	72.8676	(261)
Space heating - main system 1 (low-rate cost)	110.0582	0.1389	15.2925	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	658.5464	0.1545	101.7642	(264)
Water heating - low rate cost	282.2342	0.1297	36.6078	(264)
Space and water heating			226.5321	(265)
Pumps, fans and electric keep-hot	108.7860	0.1432	15.4505	(267)
Energy for lighting	211.9278	0.1490	31.5814	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.8092	0.1395	-122.6019	
PV Unit electricity exported	-1145.7818	0.1241	-142.1812	
Total			-264.7831	(269)
Total CO2, kg/year			8.7810	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	440.2329	1.2934	711.7234	(275)
Space heating - main system 1 (low-rate cost)	110.0582	1.5036	165.4822	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	658.5464	1.5769	1038.4471	(278)
Water heating - low rate cost	282.2342	1.4666	413.9205	(278)
Space and water heating			2329.5732	(279)
Pumps, fans and electric keep-hot	108.7860	1.5335	166.2308	(281)
Energy for lighting	211.9278	1.5547	329.4936	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-878.8092	1.5200	-1335.7927	
PV Unit electricity exported	-1145.7818	0.4553	-521.6941	
Total			-1857.4868	(283)
Total Primary energy kWh/year			967.8107	(286)

Full SAP Calculation Printout

Property Reference	HT 14 Havant	**Issued on Date**	22/06/2025
Assessment Reference	4B6P ASHP	**Prop Type Ref**	3B4P Semi
Property	65, Hulbert Road, Havant, Hampshire, PO9 3TA		

SAP Rating	81 B	**DER**	4.15	**TER**	10.14
Environmental	96 A	**% DER < TER**			59.07
CO_2 Emissions (t/year)	0.38	**DFEE**	35.17	**TFEE**	36.57
Compliance Check	See BREL	**% DFEE < TFEE**			3.84
% DPER < TPER	17.83	**DPER**	43.36	**TPER**	52.77

Assessor Details	Mrs. Naomi Sadler	**Assessor ID**	4611-0001
Client	BRICS, BRICS		

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		0 * 10 =	0.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
		Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			4.0000	(17)
Infiltration rate			0.2000	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15140.0600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.6215	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.2917 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 60.6277 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	(38)
Heat transfer coeff	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	(39)

Average = Sum(39)m / 12 = 102.9337

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	(40)
HLP (average)												1.0036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7620 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591	(42a)
Hot water usage for baths	30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)
Hot water usage for other uses	42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)

Average daily hot water use (litres/day) 132.2747 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)

Energy content (annual) Total = Sum(45)m = 2197.0559

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)

Water storage loss:

Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(64)

Total per year (kWh/year) = Sum(64)m = 2733.0949 (64)

12Total per year (kWh/year) 2733 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	112.1978	99.5740	106.4764	95.0535	93.1658	85.0461	84.6350	87.3169	87.5431	96.3254	100.8757	111.1424	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	135.8851	150.4443	135.8851	140.4146	135.8851	140.4146	135.8851	135.8851	140.4146	135.8851	140.4146	135.8851	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.4012	263.1033	256.2940	241.7977	223.4988	206.3004	194.8108	192.1087	198.9180	213.4142	231.7132	248.9116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)	150.8035	148.1756	143.1134	132.0187	125.2229	118.1196	113.7568	117.3615	121.5877	129.4696	140.1052	149.3850	(72)
Total internal gains	611.5197	626.1531	599.7224	578.6610	549.0368	529.2645	508.8826	509.7852	525.3502	543.1989	576.6629	598.6116	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.3900	0.0000	0.7700	72.1912	(76)

West			7.3500	19.6403	0.3900	0.0000	0.7700					43.3501	(80)
Solar gains	115.5413	226.0232	372.2280	542.8724	665.3105	681.0637	648.4004	556.9663	432.9166	268.1956	144.0664	95.0155	(83)
Total gains	727.0610	852.1763	971.9505	1121.5334	1214.3472	1210.3282	1157.2830	1066.7515	958.2668	811.3945	720.7292	693.6271	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	
alpha	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	
util living area	0.9762	0.9573	0.9187	0.8275	0.6863	0.5170	0.3840	0.4316	0.6581	0.8819	0.9598	0.9798	(86)
Living	19.3761	19.6462	20.0352	20.4893	20.8008	20.9468	20.9864	20.9790	20.8719	20.4288	19.8109	19.3111	
Non living	18.1853	18.5249	19.0083	19.5529	19.9001	20.0431	20.0738	20.0695	19.9805	19.4967	18.7370	18.1030	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.1693	19.6462	20.0352	20.4893	20.8008	20.9468	20.9864	20.9790	20.8719	20.4288	19.8109	19.5473	(87)
Th 2	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	(88)
util rest of house	0.9717	0.9496	0.9040	0.7983	0.6385	0.4512	0.3068	0.3502	0.5919	0.8543	0.9511	0.9759	(89)
MIT 2	19.3248	18.5249	19.0083	19.5529	19.9001	20.0431	20.0738	20.0695	19.9805	19.4967	18.7370	18.4593	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	19.4375	18.6744	19.1453	19.6778	20.0203	20.1636	20.1955	20.1908	20.0994	19.6210	18.8802	18.6044	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4375	18.6744	19.1453	19.6778	20.0203	20.1636	20.1955	20.1908	20.0994	19.6210	18.8802	18.6044	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9679	0.9341	0.8859	0.7840	0.6352	0.4573	0.3167	0.3603	0.5934	0.8380	0.9361	0.9677	(94)
Useful gains	703.7314	796.0438	861.0808	879.2786	771.3033	553.5291	366.4751	384.3055	568.6488	679.9106	674.6584	671.2000	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1558.1532	1417.8541	1301.6262	1109.3968	856.4340	572.6825	370.0993	390.2054	617.5408	928.5686	1212.5842	1482.7025	(97)
Space heating kWh	635.6898	417.8565	327.7658	165.6851	63.3372	0.0000	0.0000	0.0000	0.0000	185.0016	387.3066	603.7579	(98a)
Space heating requirement - total per year (kWh/year)												2786.4005	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	635.6898	417.8565	327.7658	165.6851	63.3372	0.0000	0.0000	0.0000	0.0000	185.0016	387.3066	603.7579	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2786.4005	
Space heating per m2											(98c) / (4) =	27.1685	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												261.3541	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	635.6898	417.8565	327.7658	165.6851	63.3372	0.0000	0.0000	0.0000	0.0000	185.0016	387.3066	603.7579	(98)
Space heating efficiency (main heating system 1)	261.3541	261.3541	261.3541	261.3541	261.3541	0.0000	0.0000	0.0000	0.0000	261.3541	261.3541	261.3541	(210)
Space heating fuel (main heating system)	243.2293	159.8814	125.4106	63.3949	24.2343	0.0000	0.0000	0.0000	0.0000	70.7858	148.1923	231.0114	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(64)
Efficiency of water heater												183.3684	(216)
(217)m	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	(217)
Fuel for water heating, kWh/month	149.1129	131.7862	139.7289	122.1197	117.8976	105.7060	103.9058	108.3045	109.8016	123.0797	131.6691	147.3820	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.1917	2.8829	3.1917	3.0888	3.1917	3.0888	3.1917	3.1917	3.0888	3.1917	3.0888	3.1917	(231)
Lighting	34.3871	27.5866	24.8387	18.1979	14.0566	11.4844	12.8229	16.6677	21.6497	28.4055	32.0840	35.3429	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1066.1399	(211)
Space heating fuel - main system 2												0.0000	(213)

Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3684	
Water heating fuel used	1490.4940	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	37.5801	(230a)
Total electricity for the above, kWh/year	37.5801	(231)
Electricity for lighting (calculated in Appendix L)	277.5240	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2871.7380	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	852.9119	0.1637	139.6293	(261)
Space heating - main system 1 (low-rate cost)	213.2280	0.1374	29.3048	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1043.3458	0.1480	154.3736	(264)
Water heating - low rate cost	447.1482	0.1242	55.5267	(264)
Space and water heating			378.8344	(265)
Pumps, fans and electric keep-hot	37.5801	0.1432	5.2145	(267)
Energy for lighting	277.5240	0.1490	41.3566	(268)
Total CO2, kg/year			425.4055	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.1500	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	852.9119	1.2882	1373.3682	(275)
Space heating - main system 1 (low-rate cost)	213.2280	1.4976	319.3234	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1043.3458	1.5531	1620.3914	(278)
Water heating - low rate cost	447.1482	1.4444	645.8647	(278)
Space and water heating			3958.9476	(279)
Pumps, fans and electric keep-hot	37.5801	1.5335	56.8570	(281)
Energy for lighting	277.5240	1.5547	431.4789	(282)
Total Primary energy kWh/year			4447.2835	(286)
Dwelling Primary energy Rate (DPER)			43.3600	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET EMISSIONS

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800	(1b) x	2.4000	(2b) =	123.0720	(1b) - (3b)
First floor	51.2800	(1c) x	2.6000	(2c) =	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		256.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4060	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3451	(21)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4400	0.4314	0.4228	0.3796	0.3710	0.3279	0.3279	0.3192	0.3451	0.3710	0.3882	0.4055 (22b)
Effective ac	0.5968	0.5930	0.5894	0.5721	0.5688	0.5537	0.5537	0.5510	0.5595	0.5688	0.5754	0.5822 (25)

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.5900	1.1450	22.4313			(27)
Heatloss Floor 1			51.7800	0.1300	6.7314			(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710			(29a)
External Roof 1	51.2800		51.2800	0.1100	5.6408			(30)
Total net area of external elements Aum(A, m2)			205.6600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.3345			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 147.6215 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0600	0.5280
E12 Gable (insulation at ceiling level)	11.8000	0.0600	0.7080
P1 Party wall - Ground floor	8.8000	0.0800	0.7040
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.1200	1.0560
E1 Steel lintel with perforated steel base plate	10.8300	0.0500	0.5415
E3 Sill	9.9000	0.0500	0.4950
E4 Jamb	35.7000	0.0500	1.7850
E5 Ground floor (normal)	20.5000	0.1600	3.2800
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5975 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 61.9320 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.4968	50.1787	49.8670	48.4026	48.1287	46.8533	46.8533	46.6171	47.3445	48.1287	48.6829	49.2623	(38)
Heat transfer coeff	112.4288	112.1107	111.7990	110.3346	110.0607	108.7853	108.7853	108.5491	109.2765	110.0607	110.6149	111.1943	(39)
Average = Sum(39)m / 12 =												110.3333	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0962	1.0931	1.0901	1.0758	1.0731	1.0607	1.0607	1.0584	1.0655	1.0731	1.0785	1.0842	(40)
HLP (average)												1.0758	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7620 (42)

Hot water usage for mixer showers

70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591	(42a)

Hot water usage for baths

30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)

Hot water usage for other uses

42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)

Average daily hot water use (litres/day) 132.2747 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)
Energy content (annual)										Total = Sum(45)m =		2197.0559	
Distribution loss (46)m = 0.15 x (45)m	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)

Water storage loss:

Store volume 210.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.7016 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.9188 (55)

Total storage loss

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)

If cylinder contains dedicated solar storage

28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

279.6460	247.2722	262.4386	229.9483	222.4069	199.8508	196.7504	204.8162	207.3608	231.9093	247.4588	276.4719	(62)
WWHRS -32.2431	-28.5160	-29.8604	-24.7256	-23.0433	-19.7183	-18.4828	-19.6546	-20.4014	-24.0509	-27.2468	-31.6460	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

247.4029	218.7562	232.5783	205.2227	199.3636	180.1325	178.2676	185.1616	186.9594	207.8584	220.2120	244.8259	(64)
									Total per year (kWh/year) = Sum(64)m =		2506.7411	(64)
12Total per year (kWh/year)											2507	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

117.1738	104.0684	111.4524	99.8690	98.1418	89.8616	89.6110	92.2929	92.3586	101.3014	105.6912	116.1184	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	132.9889	147.2377	132.9889	137.4219	132.9889	137.4219	132.9889	132.9889	137.4219	132.9889	137.4219	132.9889 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	260.4012	263.1033	256.2940	241.7977	223.4988	206.3004	194.8108	192.1087	198.9180	213.4142	231.7132	248.9116 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798 (71)

Water heating gains (Table 5)

	157.4917	154.8637	149.8016	138.7069	131.9111	124.8077	120.4449	124.0496	128.2759	136.1578	146.7933	156.0732 (72)

Total internal gains

	618.3117	632.6347	606.5144	585.3564	555.8287	532.9599	512.6746	513.5771	529.0456	549.9908	583.3583	605.4036 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.6300	0.7000	0.7700	73.4684	(76)
West	7.3500	19.6403	0.6300	0.7000	0.7700	44.1171	(80)

Solar gains	117.5854	230.0221	378.8136	552.4771	677.0814	693.1133	659.8721	566.8204	440.5759	272.9406	146.6152	96.6966	(83)
Total gains	735.8971	862.6567	985.3280	1137.8334	1232.9100	1226.0732	1172.5467	1080.3975	969.6215	822.9314	729.9735	702.1001	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.4065	37.5127	37.6173	38.1165	38.2114	38.6594	38.6594	38.7435	38.4856	38.2114	38.0199	37.8218	
alpha	3.4938	3.5008	3.5078	3.5411	3.5474	3.5773	3.5773	3.5829	3.5657	3.5474	3.5347	3.5215	
util living area	0.9766	0.9592	0.9235	0.8375	0.7026	0.5328	0.3983	0.4461	0.6743	0.8878	0.9609	0.9799	(86)
MIT	19.1825	19.4656	19.8829	20.3973	20.7517	20.9320	20.9815	20.9724	20.8416	20.3465	19.6824	19.1432	(87)
Th 2	20.0039	20.0065	20.0089	20.0206	20.0228	20.0331	20.0331	20.0350	20.0291	20.0228	20.0184	20.0138	(88)
util rest of house	0.9720	0.9514	0.9090	0.8082	0.6531	0.4630	0.3149	0.3589	0.6056	0.8603	0.9522	0.9759	(89)
MIT 2	17.8904	18.2484	18.7700	19.3986	19.7986	19.9856	20.0244	20.0210	19.9059	19.3563	18.5343	17.8469	(90)
Living area fraction									fLA = Living area / (4) =			0.1334	(91)
MIT	18.0627	18.4108	18.9185	19.5318	19.9257	20.1119	20.1520	20.1479	20.0307	19.4884	18.6875	18.0198	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0627	18.4108	18.9185	19.5318	19.9257	20.1119	20.1520	20.1479	20.0307	19.4884	18.6875	18.0198	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9595	0.9348	0.8892	0.7915	0.6478	0.4689	0.3254	0.3694	0.6057	0.8421	0.9362	0.9645	(94)
Useful gains	706.0782	806.4514	876.1515	900.6175	798.7297	574.9656	381.4946	399.0815	587.3429	692.9692	683.3871	677.2058	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1547.3286	1514.7046	1388.3735	1173.0582	905.3250	599.6107	386.4102	406.8339	648.0916	978.2630	1281.7473	1536.6863	(97)
Space heating kWh	625.8903	475.9462	381.0932	196.1573	79.3069	0.0000	0.0000	0.0000	0.0000	212.2586	430.8193	639.4535	(98a)
Space heating requirement - total per year (kWh/year)												3040.9252	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	625.8903	475.9462	381.0932	196.1573	79.3069	0.0000	0.0000	0.0000	0.0000	212.2586	430.8193	639.4535	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3040.9252	
Space heating per m2											(98c) / (4) =	29.6502	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 92.3000 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	625.8903	475.9462	381.0932	196.1573	79.3069	0.0000	0.0000	0.0000	0.0000	212.2586	430.8193	639.4535	(98)
Space heating efficiency (main heating system 1)	92.3000	92.3000	92.3000	92.3000	92.3000	0.0000	0.0000	0.0000	0.0000	92.3000	92.3000	92.3000	(210)
Space heating fuel (main heating system)	678.1043	515.6513	412.8854	212.5215	85.9230	0.0000	0.0000	0.0000	0.0000	229.9659	466.7598	692.7990	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	247.4029	218.7562	232.5783	205.2227	199.3636	180.1325	178.2676	185.1616	186.9594	207.8584	220.2120	244.8259	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.0506	85.7545	85.1599	83.9586	82.1701	79.8000	79.8000	79.8000	79.8000	84.1068	85.5369	86.1111	(217)
Fuel for water heating, kWh/month	287.5086	255.0959	273.1076	244.4333	242.6231	225.7299	223.3930	232.0321	234.2850	247.1362	257.4468	284.3139	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)

Lighting	27.6325	22.1678	19.9596	14.6233	11.2954	9.2285	10.3041	13.3936	17.3970	22.8258	25.7817	28.4005	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-46.7844	-65.3560	-93.0886	-103.6635	-110.9130	-103.1700	-101.8361	-96.5220	-87.0719	-74.1992	-51.1962	-40.5138	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-28.2996	-59.3080	-117.4871	-175.9166	-232.1166	-233.0900	-230.4013	-195.3526	-143.5130	-84.7009	-37.7416	-22.4006	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3294.6101	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.8000	
Water heating fuel used	3007.1054	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	86.0000	(231)
Electricity for lighting (calculated in Appendix L)	223.0098	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2534.6425	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	4076.0829	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3294.6101	0.2100	691.8681	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3007.1054	0.2100	631.4921	(264)
Space and water heating			1323.3603	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	223.0098	0.1443	32.1872	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-974.3148	0.1348	-131.3327	
PV Unit electricity exported	-1560.3277	0.1260	-196.5724	
Total			-327.9051	(269)
Total CO2, kg/year			1039.5716	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1400	(273)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3294.6101	1.1300	3722.9095	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3007.1054	1.1300	3398.0291	(278)
Space and water heating			7120.9385	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	223.0098	1.5338	342.0599	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-974.3148	1.4982	-1459.7096	
PV Unit electricity exported	-1560.3277	0.4624	-721.5613	
Total			-2181.2709	(283)
Total Primary energy kWh/year			5411.8284	(286)
Target Primary Energy Rate (TPER)			52.7700	(287)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

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2. Ventilation rate

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m3 per hour

Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3560	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3026	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3858	0.3783	0.3707	0.3329	0.3253	0.2875	0.2875	0.2799	0.3026	0.3253	0.3404	0.3556	(22b)

If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0.0000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5744	0.5715	0.5687	0.5554	0.5529	0.5413	0.5413	0.5392	0.5458	0.5529	0.5579	0.5632	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15140.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		147.6215 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		19.2917 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.6277 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	48.6036	48.3591	48.1194	46.9935	46.7828	45.8022	45.8022	45.6207	46.1800	46.7828	47.2090	47.6545	(38)
Heat transfer coeff	109.2313	108.9867	108.7470	107.6211	107.4105	106.4299	106.4299	106.2483	106.8076	107.4105	107.8366	108.2821	(39)
Average = Sum(39)m / 12 =												107.6201	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0650	1.0627	1.0603	1.0493	1.0473	1.0377	1.0377	1.0360	1.0414	1.0473	1.0514	1.0558	(40)
HLP (average)												1.0493	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.7620 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)
Hot water usage for other uses	42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)
Average daily hot water use (litres/day)												67.2490	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.3687	71.3559	69.1584	66.4235	63.9837	61.4481	60.9214	63.1144	65.3636	67.9675	70.7265	73.2658	(44)
Energy conte	116.1981	101.6098	106.2939	90.9305	86.1343	75.5576	73.6792	78.1488	80.5999	92.2312	100.7629	114.7165	(45)
Energy content (annual)										Total = Sum(45)m =		1116.8629	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	98.7684	86.3684	90.3498	77.2909	73.2142	64.2239	62.6273	66.4265	68.5099	78.3965	85.6485	97.5090	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	98.7684	86.3684	90.3498	77.2909	73.2142	64.2239	62.6273	66.4265	68.5099	78.3965	85.6485	97.5090	(64)
										Total per year (kWh/year) = Sum(64)m =		949.3334	(64)
12Total per year (kWh/year)												949	(64)
Electric shower(s)													
	56.4823	50.3262	54.9542	52.4422	53.4262	50.9634	52.6622	53.4262	52.4422	54.9542	53.9209	56.4823	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												642.4824	(64a)
Heat gains from water heating, kWh/month													
	38.8127	34.1736	36.3260	32.4333	31.6601	28.7968	28.8224	29.9632	30.2380	33.3377	34.8923	38.4978	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	135.8851	150.4443	135.8851	140.4146	135.8851	140.4146	135.8851	135.8851	140.4146	135.8851	140.4146	135.8851	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	260.4012	263.1033	256.2940	241.7977	223.4988	206.3004	194.8108	192.1087	198.9180	213.4142	231.7132	248.9116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)													
	52.1676	50.8536	48.8253	45.0462	42.5539	39.9956	38.7398	40.2731	41.9972	44.8087	48.4616	51.7444	(72)
Total internal gains													
	512.8838	528.8311	505.4343	491.6885	466.3677	451.1406	433.8656	432.6968	445.7598	458.5380	485.0193	500.9710	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.3900	0.0000	0.7700	72.1912	(76)
West	7.3500	19.6403	0.3900	0.0000	0.7700	43.3501	(80)

Solar gains	115.5413	226.0232	372.2280	542.8724	665.3105	681.0637	648.4004	556.9663	432.9166	268.1956	144.0664	95.0155	(83)
Total gains	628.4250	754.8543	877.6624	1034.5609	1131.6782	1132.2042	1082.2660	989.6632	878.6764	726.7336	629.0857	595.9865	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	38.5015	38.5879	38.6730	39.0776	39.1542	39.5149	39.5149	39.5825	39.3752	39.1542	38.9995	38.8390	
alpha	3.5668	3.5725	3.5782	3.6052	3.6103	3.6343	3.6343	3.6388	3.6250	3.6103	3.6000	3.5893	
util living area													
	0.9852	0.9714	0.9415	0.8628	0.7318	0.5598	0.4208	0.4739	0.7103	0.9142	0.9740	0.9877	(86)
MIT	19.0940	19.3833	19.8113	20.3492	20.7286	20.9246	20.9794	20.9685	20.8203	20.2804	19.5930	19.0487	(87)
Th 2	20.0295	20.0314	20.0334	20.0424	20.0441	20.0520	20.0520	20.0535	20.0490	20.0441	20.0407	20.0371	(88)
util rest of house													
	0.9823	0.9658	0.9299	0.8366	0.6842	0.4895	0.3350	0.3842	0.6435	0.8916	0.9680	0.9852	(89)
MIT 2	18.2882	18.5751	18.9951	19.5124	19.8503	20.0104	20.0443	20.0408	19.9376	19.4617	18.7919	18.2488	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	18.3956	18.6829	19.1040	19.6240	19.9675	20.1324	20.1691	20.1646	20.0554	19.5709	18.8987	18.3555	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3956	18.6829	19.1040	19.6240	19.9675	20.1324	20.1691	20.1646	20.0554	19.5709	18.8987	18.3555	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9754	0.9555	0.9161	0.8235	0.6801	0.4957	0.3459	0.3951	0.6440	0.8780	0.9583	0.9791	(94)
Useful gains	612.9487	721.2746	804.0511	851.9505	769.6300	561.2214	374.3249	391.0249	565.8872	638.0668	602.8654	583.5513	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1539.6854	1502.1548	1370.6447	1154.1301	888.0115	588.8082	379.8545	399.9788	636.0767	963.5669	1272.3371	1532.7830	(97)
Space heating kWh													
	689.4921	524.7515	421.5456	217.5693	88.0758	0.0000	0.0000	0.0000	0.0000	242.1721	482.0196	706.2284	(98a)
Space heating requirement - total per year (kWh/year)												3371.8545	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	689.4921	524.7515	421.5456	217.5693	88.0758	0.0000	0.0000	0.0000	0.0000	242.1721	482.0196	706.2284	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3371.8545	
Space heating per m2											(98c) / (4) =	32.8769	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

	0.0000	0.0000	0.0000	0.0000	0.0000	1000.4411	787.5813	807.4872	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8656	0.9150	0.8877	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	866.0015	720.6688	716.7761	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1265.4184	1209.7935	1104.2748	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	287.5802	363.9088	288.2991	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	71.8950	90.9772	72.0748	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												234.9470	(107)
Energy for space heating												32.8769	(99)
Energy for space cooling												2.2908	(108)
Total												35.1677	(109)
Fabric Energy Efficiency (DFEE)												35.2	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1560	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4060	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3451	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate													
	0.4400	0.4314	0.4228	0.3796	0.3710	0.3279	0.3279	0.3192	0.3451	0.3710	0.3882	0.4055	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5968	0.5930	0.5894	0.5721	0.5688	0.5537	0.5537	0.5510	0.5595	0.5688	0.5754	0.5822	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
TER Semi-glazed door			1.9600	1.0000	1.9600			(26a)
TER Opening Type			19.5900	1.1450	22.4313			(27)
Heatloss Floor 1			51.7800	0.1300	6.7314			(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710			(29a)
External Roof 1	51.2800		51.2800	0.1100	5.6408			(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.3345			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.6215	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0600	0.5280
E12 Gable (insulation at ceiling level)	11.8000	0.0600	0.7080
P1 Party wall - Ground floor	8.8000	0.0800	0.7040
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.1200	1.0560
E1 Steel lintel with perforated steel base plate	10.8300	0.0500	0.5415
E3 Sill	9.9000	0.0500	0.4950
E4 Jamb	35.7000	0.0500	1.7850
E5 Ground floor (normal)	20.5000	0.1600	3.2800
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000

E18 Party wall between dwellings 10.0000 0.0600 0.6000
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.5975 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 61.9320 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.4968	50.1787	49.8670	48.4026	48.1287	46.8533	46.8533	46.6171	47.3445	48.1287	48.6829	49.2623	(38)
Heat transfer coeff	112.4288	112.1107	111.7990	110.3346	110.0607	108.7853	108.7853	108.5491	109.2765	110.0607	110.6149	111.1943	(39)
Average = Sum(39)m / 12 =												110.3333	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0962	1.0931	1.0901	1.0758	1.0731	1.0607	1.0607	1.0584	1.0655	1.0731	1.0785	1.0842	(40)
HLP (average)												1.0758	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7620 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)

Hot water usage for other uses

42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)

Average daily hot water use (litres/day) 67.2490 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	73.3687	71.3559	69.1584	66.4235	63.9837	61.4481	60.9214	63.1144	65.3636	67.9675	70.7265	73.2658	(44)
Energy conte	116.1981	101.6098	106.2939	90.9305	86.1343	75.5576	73.6792	78.1488	80.5999	92.2312	100.7629	114.7165	(45)
Energy content (annual)										Total = Sum(45)m =		1116.8629	
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	98.7684	86.3684	90.3498	77.2909	73.2142	64.2239	62.6273	66.4265	68.5099	78.3965	85.6485	97.5090	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	98.7684	86.3684	90.3498	77.2909	73.2142	64.2239	62.6273	66.4265	68.5099	78.3965	85.6485	97.5090	(64)
									Total per year (kWh/year) = Sum(64)m =			949.3334	(64)
12Total per year (kWh/year)												949	(64)
Electric shower(s)	56.4823	50.3262	54.9542	52.4422	53.4262	50.9634	52.6622	53.4262	52.4422	54.9542	53.9209	56.4823	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			642.4824	(64a)
Heat gains from water heating, kWh/month	38.8127	34.1736	36.3260	32.4333	31.6601	28.7968	28.8224	29.9632	30.2380	33.3377	34.8923	38.4978	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	138.0997	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	132.9889	147.2377	132.9889	137.4219	132.9889	137.4219	132.9889	132.9889	137.4219	132.9889	137.4219	132.9889	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	260.4012	263.1033	256.2940	241.7977	223.4988	206.3004	194.8108	192.1087	198.9180	213.4142	231.7132	248.9116	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	36.8100	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)	52.1676	50.8536	48.8253	45.0462	42.5539	39.9956	38.7398	40.2731	41.9972	44.8087	48.4616	51.7444	(72)
Total internal gains	509.9875	525.6245	502.5381	488.6957	463.4715	448.1478	430.9694	429.8006	442.7670	455.6418	482.0265	498.0748	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.6300	0.7000	0.7700	73.4684	(76)
West	7.3500	19.6403	0.6300	0.7000	0.7700	44.1171	(80)

Solar gains	117.5854	230.0221	378.8136	552.4771	677.0814	693.1133	659.8721	566.8204	440.5759	272.9406	146.6152	96.6966	(83)
Total gains	627.5730	755.6466	881.3517	1041.1728	1140.5529	1141.2611	1090.8415	996.6209	883.3429	728.5824	628.6418	594.7713	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	37.4065	37.5127	37.6173	38.1165	38.2114	38.6594	38.6594	38.7435	38.4856	38.2114	38.0199	37.8218	
alpha	3.4938	3.5008	3.5078	3.5411	3.5474	3.5773	3.5773	3.5829	3.5657	3.5474	3.5347	3.5215	
util living area													

	0.9854	0.9719	0.9425	0.8651	0.7361	0.5647	0.4256	0.4791	0.7155	0.9160	0.9745	0.9878	(86)
MIT	19.0253	19.3196	19.7583	20.3151	20.7096	20.9181	20.9771	20.9654	20.8071	20.2468	19.5424	18.9851	(87)
Th 2	20.0039	20.0065	20.0089	20.0206	20.0228	20.0331	20.0331	20.0350	20.0291	20.0228	20.0184	20.0138	(88)
util rest of house													
	0.9825	0.9663	0.9310	0.8389	0.6880	0.4929	0.3375	0.3871	0.6480	0.8936	0.9685	0.9853	(89)
MIT 2	18.2019	18.4942	18.9253	19.4631	19.8156	19.9880	20.0246	20.0211	19.9097	19.4136	18.7260	18.1691	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	18.3118	18.6043	19.0364	19.5767	19.9348	20.1120	20.1516	20.1470	20.0294	19.5248	18.8349	18.2780	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3118	18.6043	19.0364	19.5767	19.9348	20.1120	20.1516	20.1470	20.0294	19.5248	18.8349	18.2780	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9755	0.9558	0.9168	0.8252	0.6833	0.4991	0.3486	0.3982	0.6480	0.8795	0.9587	0.9792	(94)
Useful gains	612.1735	722.2575	808.0198	859.1975	779.3286	569.5823	380.2238	396.8704	572.4039	640.8245	602.6819	582.4032	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1575.3267	1536.4010	1401.5615	1178.0135	906.3325	599.6282	386.3666	406.7386	647.9406	982.2654	1298.0502	1565.3898	(97)
Space heating kWh													
	716.5860	547.1044	441.5951	229.5475	94.4909	0.0000	0.0000	0.0000	0.0000	254.0320	500.6652	731.3420	(98a)
Space heating requirement - total per year (kWh/year)												3515.3631	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	716.5860	547.1044	441.5951	229.5475	94.4909	0.0000	0.0000	0.0000	0.0000	254.0320	500.6652	731.3420	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3515.3631	
Space heating per m2											(98c) / (4) =	34.2762	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1022.5817	805.0111	824.9732	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8596	0.9102	0.8820	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	878.9705	732.7076	727.6520	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1279.2489	1222.9282	1115.4366	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	288.2004	364.7241	288.5118	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction										fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	72.0501	91.1810	72.1279	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												235.3591	(107)
Energy for space heating												34.2762	(99)
Energy for space cooling												2.2948	(108)
Total												36.5710	(109)
Fabric Energy Efficiency (TFEE)												36.6	(109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF ENERGY RATING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1700 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15140.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 147.6215 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.2917 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 60.6277 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	(38)
Heat transfer coeff	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	(39)
Average = Sum(39)m / 12 =												102.9337	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	(40)
HLP (average)												1.0036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7620 (42)
Hot water usage for mixer showers

70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591	(42a)

Hot water usage for baths

30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)

Hot water usage for other uses

42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)

Average daily hot water use (litres/day) 132.2747 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)
Energy content (annual)										Total = Sum(45)m =		2197.0559	
Distribution loss (46)m = 0.15 x (45)m	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)

Water storage loss:
Store volume 210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3300 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7182 (55)
Total storage loss

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)

If cylinder contains dedicated solar storage

22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Primary loss
Combi loss
Total heat required for water heating calculated for each month

273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(64)
									Total per year (kWh/year) = Sum(64)m =		2733.0949	(64)

Electric shower(s)

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)

Heat gains from water heating, kWh/month

	112.1978	99.5740	106.4764	95.0535	93.1658	85.0461	84.6350	87.3169	87.5431	96.3254	100.8757	111.1424 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	39.2864	34.8938	28.3776	21.4836	16.0593	13.5579	14.6498	19.0424	25.5586	32.4526	37.8769	40.3783 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	388.6584	392.6915	382.5283	360.8921	333.5803	307.9110	290.7624	286.7293	296.8925	318.5287	345.8405	371.5098 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798 (71)

Water heating gains (Table 5)

	150.8035	148.1756	143.1134	132.0187	125.2229	118.1196	113.7568	117.3615	121.5877	129.4696	140.1052	149.3850 (72)

Total internal gains

	688.3222	685.3347	663.5931	623.9683	584.4363	549.1624	528.7428	532.7070	553.6127	590.0247	633.3965	670.8469 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.3900	0.0000	0.7700	72.1912	(76)
West	7.3500	19.6403	0.3900	0.0000	0.7700	43.3501	(80)

Solar gains	115.5413	226.0232	372.2280	542.8724	665.3105	681.0637	648.4004	556.9663	432.9166	268.1956	144.0664	95.0155	(83)
Total gains	803.8635	911.3579	1035.8212	1166.8407	1249.7468	1230.2260	1177.1432	1089.6734	986.5293	858.2203	777.4628	765.8624	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	
alpha	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	
util living area	0.9677	0.9484	0.9045	0.8132	0.6732	0.5098	0.3779	0.4233	0.6447	0.8656	0.9501	0.9726	(86)
Living	19.4858	19.7242	20.1059	20.5228	20.8135	20.9492	20.9871	20.9803	20.8806	20.4729	19.8864	19.4161	
Non living	18.3230	18.6215	19.0933	19.5902	19.9124	20.0448	20.0741	20.0703	19.9878	19.5464	18.8300	18.2353	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2254	19.7242	20.1059	20.5228	20.8135	20.9492	20.9871	20.9803	20.8806	20.4729	19.8864	19.6376	(87)
Th 2	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	(88)
util rest of house	0.9618	0.9393	0.8880	0.7828	0.6252	0.4446	0.3018	0.3432	0.5786	0.8357	0.9397	0.9675	(89)
MIT 2	19.3797	18.6215	19.0933	19.5902	19.9124	20.0448	20.0741	20.0703	19.9878	19.5464	18.8300	18.5677	(90)
Living area fraction									fLA = Living area / (4) =			0.1334	(91)
MIT	19.4925	18.7686	19.2283	19.7146	20.0326	20.1655	20.1959	20.1916	20.1069	19.6700	18.9709	18.7105	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4925	18.7686	19.2283	19.7146	20.0326	20.1655	20.1959	20.1916	20.1069	19.6700	18.9709	18.7105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9574	0.9227	0.8698	0.7694	0.6225	0.4508	0.3115	0.3531	0.5806	0.8202	0.9234	0.9577	(94)
Useful gains	769.6077	840.9423	900.9477	897.7293	778.0119	554.6030	366.7117	384.7697	572.7851	703.8745	717.9168	733.4595	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1563.8216	1427.5465	1310.1737	1113.1822	857.7082	572.8734	370.1408	390.2869	618.3107	933.6072	1221.9188	1493.6139	(97)
Space heating kWh	590.8951	394.1980	304.4642	155.1261	59.2940	0.0000	0.0000	0.0000	0.0000	170.9212	362.8814	565.5548	(98a)
Space heating requirement - total per year (kWh/year)												2603.3349	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	590.8951	394.1980	304.4642	155.1261	59.2940	0.0000	0.0000	0.0000	0.0000	170.9212	362.8814	565.5548	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2603.3349	
Space heating per m2											(98c) / (4) =	25.3835	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	261.3541	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	590.8951	394.1980	304.4642	155.1261	59.2940	0.0000	0.0000	0.0000	0.0000	170.9212	362.8814	565.5548	(98)
Space heating efficiency (main heating system 1)	261.3541	261.3541	261.3541	261.3541	261.3541	0.0000	0.0000	0.0000	0.0000	261.3541	261.3541	261.3541	(210)
Space heating fuel (main heating system)	226.0899	150.8291	116.4949	59.3548	22.6872	0.0000	0.0000	0.0000	0.0000	65.3983	138.8466	216.3941	(211)
Space heating efficiency (main heating system 2)													

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating												
Water heating requirement												
	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519 (64)
Efficiency of water heater												183.3684 (216)
(217)m	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684 (217)
Fuel for water heating, kWh/month												
	149.1129	131.7862	139.7289	122.1197	117.8976	105.7060	103.9058	108.3045	109.8016	123.0797	131.6691	147.3820 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	3.1917	2.8829	3.1917	3.0888	3.1917	3.0888	3.1917	3.1917	3.0888	3.1917	3.0888	3.1917 (231)
Lighting	34.3871	27.5866	24.8387	18.1979	14.0566	11.4844	12.8229	16.6677	21.6497	28.4055	32.0840	35.3429 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)

Annual totals kWh/year		
Space heating fuel - main system 1	996.0949	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3684	
Water heating fuel used	1490.4940	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	37.5801	(230a)
Total electricity for the above, kWh/year	37.5801	(231)
Electricity for lighting (calculated in Appendix L)	277.5240	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	2801.6930	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	796.8759	17.5600	156.1877	(240)
Space heating - main system 1 (low-rate cost)	199.2190	0.0940	18.7266	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1043.3458	19.6000	204.4958	(245)
Low-rate cost	447.1482	9.4000	42.0319	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	37.5801	18.5800	6.2541	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	277.5240	18.5800	51.5640	(250)
Additional standing charges			7.0000	(251)
Total energy cost			486.2600	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1863	(257)
SAP value		80.7697	
SAP rating (Section 12)		81	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	796.8759	0.1637	130.4668	(261)
Space heating - main system 1 (low-rate cost)	199.2190	0.1374	27.3820	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1043.3458	0.1480	154.3736	(264)
Water heating - low rate cost	447.1482	0.1242	55.5267	(264)
Space and water heating			367.7492	(265)
Pumps, fans and electric keep-hot	37.5801	0.1432	5.2145	(267)
Energy for lighting	277.5240	0.1490	41.3566	(268)
Total CO2, kg/year			414.3202	(272)
CO2 emissions per m2			4.0400	(273)
EI value			96.2375	
EI rating			96	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15140.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		147.6215 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		19.2917 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	60.6277 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	(38)
Heat transfer coeff	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	(39)
Average = Sum(39)m / 12 =												102.9337	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	(40)
HLP (average)												1.0036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7620	(42)
Hot water usage for mixer showers													
	70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591	(42a)
Hot water usage for baths													
	30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)
Hot water usage for other uses													
	42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)
Average daily hot water use (litres/day)												132.2747	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)
Energy content (annual)										Total = Sum(45)m =		2197.0559	
Distribution loss (46)m = 0.15 x (45)m													
	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(64)
										Total per year (kWh/year) = Sum(64)m =		2733.0949	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.1978	99.5740	106.4764	95.0535	93.1658	85.0461	84.6350	87.3169	87.5431	96.3254	100.8757	111.1424	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.2864	34.8938	28.3776	21.4836	16.0593	13.5579	14.6498	19.0424	25.5586	32.4526	37.8769	40.3783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	388.6584	392.6915	382.5283	360.8921	333.5803	307.9110	290.7624	286.7293	296.8925	318.5287	345.8405	371.5098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)													
	150.8035	148.1756	143.1134	132.0187	125.2229	118.1196	113.7568	117.3615	121.5877	129.4696	140.1052	149.3850	(72)
Total internal gains													
	688.3222	685.3347	663.5931	623.9683	584.4363	549.1624	528.7428	532.7070	553.6127	590.0247	633.3965	670.8469	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	26.6540	0.3900	0.0000	0.7700	97.9715	(76)
West	7.3500	26.6540	0.3900	0.0000	0.7700	58.8309	(80)

Solar gains	156.8024	258.7564	419.4885	624.8523	737.0071	806.2193	770.9813	665.7561	522.6721	327.2259	188.3280	128.5730	(83)
Total gains	845.1246	944.0912	1083.0816	1248.8207	1321.4434	1355.3817	1299.7241	1198.4631	1076.2848	917.2506	821.7245	799.4199	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	
alpha	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	
util living area													
	0.9552	0.9346	0.8761	0.7519	0.5780	0.3873	0.2600	0.2816	0.5177	0.7922	0.9227	0.9604	(86)
Living	19.6987	19.8857	20.2743	20.6725	20.9039	20.9834	20.9973	20.9964	20.9525	20.6786	20.1496	19.6683	
Non living	18.5914	18.8232	19.2973	19.7588	20.0020	20.0709	20.0795	20.0792	20.0496	19.7799	19.1564	18.5543	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3343	19.8857	20.2743	20.6725	20.9039	20.9834	20.9973	20.9964	20.9525	20.6786	20.1496	19.8545	(87)
Th 2	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	(88)

util rest of house													
	0.9469	0.9229	0.8550	0.7144	0.5228	0.3217	0.1882	0.2040	0.4434	0.7481	0.9060	0.9528	(89)
MIT 2	19.4867	18.8232	19.2973	19.7588	20.0020	20.0709	20.0795	20.0792	20.0496	19.7799	19.1564	18.8293	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	19.5998	18.9649	19.4276	19.8806	20.1223	20.1926	20.2019	20.2015	20.1701	19.8998	19.2889	18.9661	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5998	18.9649	19.4276	19.8806	20.1223	20.1926	20.2019	20.2015	20.1701	19.8998	19.2889	18.9661	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9418	0.9053	0.8376	0.7056	0.5254	0.3298	0.1978	0.2143	0.4509	0.7385	0.8884	0.9411	(94)
Useful gains	795.9604	854.7254	907.1415	881.1360	694.3403	447.0664	257.0313	256.8344	485.2952	677.3547	729.9991	752.3402	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1471.9293	1365.4030	1238.0457	1027.3442	733.1245	452.1482	257.5293	257.4936	501.2927	813.1515	1110.5401	1386.1105	(97)
Space heating kWh	502.9208	343.1753	246.1927	105.2699	28.8554	0.0000	0.0000	0.0000	0.0000	101.0328	273.9895	471.5251	(98a)
Space heating requirement - total per year (kWh/year)												2072.9616	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	502.9208	343.1753	246.1927	105.2699	28.8554	0.0000	0.0000	0.0000	0.0000	101.0328	273.9895	471.5251	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2072.9616	
Space heating per m2											(98c) / (4) =	20.2122	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												261.3541	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	502.9208	343.1753	246.1927	105.2699	28.8554	0.0000	0.0000	0.0000	0.0000	101.0328	273.9895	471.5251	(98)
Space heating efficiency (main heating system 1)	261.3541	261.3541	261.3541	261.3541	261.3541	0.0000	0.0000	0.0000	0.0000	261.3541	261.3541	261.3541	(210)
Space heating fuel (main heating system)	192.4289	131.3066	94.1989	40.2786	11.0407	0.0000	0.0000	0.0000	0.0000	38.6575	104.8346	180.4162	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.4260	241.6542	256.2186	223.9289	216.1869	193.8315	190.5304	198.5962	201.3414	225.6893	241.4394	270.2519	(64)
Efficiency of water heater												183.3684	(216)
(217)m	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	(217)
Fuel for water heating, kWh/month	149.1129	131.7862	139.7289	122.1197	117.8976	105.7060	103.9058	108.3045	109.8016	123.0797	131.6691	147.3820	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	3.1917	2.8829	3.1917	3.0888	3.1917	3.0888	3.1917	3.1917	3.0888	3.1917	3.0888	3.1917	(231)
Lighting	34.3871	27.5866	24.8387	18.1979	14.0566	11.4844	12.8229	16.6677	21.6497	28.4055	32.0840	35.3429	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												793.1620	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												183.3684	
Water heating fuel used												1490.4940	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)													
mechanical ventilation fans (SFP = 0.1201)												37.5801	(230a)
Total electricity for the above, kWh/year												37.5801	(231)
Electricity for lighting (calculated in Appendix L)												277.5240	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												2598.7602	(238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	634.5296	27.8600	197.9732	(240)
Space heating - main system 1 (low-rate cost)	158.6324	0.1450	23.0017	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	1043.3458	31.2000	325.5239	(245)
Low-rate cost	447.1482	14.5000	64.8365	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	37.5801	29.5300	9.9050	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	277.5240	29.5300	81.9528	(250)
Additional standing charges			3.0000	(251)
Total energy cost			706.1932	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	634.5296	0.1647	104.5115	(261)
Space heating - main system 1 (low-rate cost)	158.6324	0.1383	21.9332	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	1043.3458	0.1480	154.3736	(264)
Water heating - low rate cost	447.1482	0.1242	55.5267	(264)
Space and water heating			336.3450	(265)
Pumps, fans and electric keep-hot	37.5801	0.1432	5.2145	(267)
Energy for lighting	277.5240	0.1490	41.3566	(268)
Total CO2, kg/year			382.9161	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	634.5296	1.2910	1023.9932	(275)
Space heating - main system 1 (low-rate cost)	158.6324	1.5009	238.0886	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	1043.3458	1.5531	1620.3914	(278)
Water heating - low rate cost	447.1482	1.4444	645.8647	(278)
Space and water heating			3528.3378	(279)
Pumps, fans and electric keep-hot	37.5801	1.5335	56.8570	(281)
Energy for lighting	277.5240	1.5547	431.4789	(282)
Total Primary energy kWh/year			4016.6737	(286)

SAP 10 EPC IMPROVEMENTS

4B6P ASHP

Current energy efficiency rating: B 81
Current environmental impact rating: A 96

N	Solar water heating	Recommended
U	Solar photovoltaic panels	Recommended
V2	Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.9	-£ 97	-47 kg (12.4%)
U Solar photovoltaic panels	+ 8.2	-£ 342	-265 kg (79.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£97	0.46 kg/m²	B 83	A 97
Solar photovoltaic panels	£342	2.59 kg/m²	B 91	A 99
Total Savings	£439	3.05 kg/m²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 572 TEST (30 May 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£706	£609	£97
Space heating	£234	£258	-£24
Water heating	£390	£269	£121
Lighting	£82	£82	£0
Generated (PV)	-£0	-£342	£342
Total cost of fuels	£706	£267	£439
Total cost of uses	£706	£267	£439
Delivered energy	25 kWh/m²	2 kWh/m²	23 kWh/m²
Carbon dioxide emissions	0.4 tonnes	0.1 tonnes	0.3 tonnes
CO2 emissions per m²	4 kg/m²	1 kg/m²	3 kg/m²
Primary energy	39 kWh/m²	15 kWh/m²	24 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800 (1b)	x	2.4000 (2b)	=	123.0720	(1b) - (3b)
First floor	51.2800 (1c)	x	2.6000 (2c)	=	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	256.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15140.0600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.6215	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.2917	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 60.6277	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	(38)
Heat transfer coeff	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	(39)
Average = Sum(39)m / 12 =												102.9337	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	(40)
HLP (average)												1.0036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7620 (42)

Hot water usage for mixer showers

	70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591 (42a)

Hot water usage for baths

	30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502 (42b)

Hot water usage for other uses

	42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156 (42c)

Average daily hot water use (litres/day) 132.2747 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)
Energy content (annual)										Total = Sum(45)m =		2197.0559	
Distribution loss (46)m = 0.15 x (45)m													
	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.4260	241.6542	254.8229	217.1753	203.3926	181.2248	177.5035	186.4998	195.9386	224.2936	241.4394	270.2519	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												621.6362	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												621.6362	
Solar input	-0.0000	-16.2068	-58.3972	-80.2448	-104.6974	-96.3794	-95.5839	-83.6695	-57.7803	-28.6769	-0.0000	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	273.4260	225.4474	196.4257	136.9306	98.6952	84.8453	81.9195	102.8303	138.1582	195.6167	241.4394	270.2519	(64)
										Total per year (kWh/year) = Sum(64)m =		2045.9862	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	112.1978	99.5740	105.3598	89.6506	82.9304	74.9607	74.2135	77.6398	83.2208	95.2088	100.8757	111.1424	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	39.2864	34.8938	28.3776	21.4836	16.0593	13.5579	14.6498	19.0424	25.5586	32.4526	37.8769	40.3783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	388.6584	392.6915	382.5283	360.8921	333.5803	307.9110	290.7624	286.7293	296.8925	318.5287	345.8405	371.5098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)													
	150.8035	148.1756	141.6126	124.5147	111.4656	104.1121	99.7493	104.3545	115.5845	127.9688	140.1052	149.3850	(72)
Total internal gains													
	688.3222	685.3347	662.0923	616.4643	570.6790	535.1549	514.7354	519.7001	547.6095	588.5239	633.3965	670.8469	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	19.6403	0.3900	0.0000	0.7700	72.1912	(76)
West	7.3500	19.6403	0.3900	0.0000	0.7700	43.3501	(80)

Solar gains	115.5413	226.0232	372.2280	542.8724	665.3105	681.0637	648.4004	556.9663	432.9166	268.1956	144.0664	95.0155	(83)
Total gains	803.8635	911.3579	1034.3204	1159.3367	1235.9895	1216.2186	1163.1358	1076.6664	980.5261	856.7195	777.4628	765.8624	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571
alpha	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238
util living area												

	0.9677	0.9484	0.9048	0.8156	0.6783	0.5149	0.3822	0.4280	0.6475	0.8662	0.9501	0.9726	(86)
Living	19.4858	19.7242	20.1043	20.5174	20.8087	20.9476	20.9866	20.9795	20.8788	20.4715	19.8864	19.4161	
Non living	18.3230	18.6215	19.0913	19.5842	19.9078	20.0436	20.0739	20.0699	19.9863	19.5449	18.8300	18.2353	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.2254	19.7242	20.1043	20.5174	20.8087	20.9476	20.9866	20.9795	20.8788	20.4715	19.8864	19.6376	(87)
Th 2	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	(88)
util rest of house													
	0.9618	0.9393	0.8884	0.7854	0.6303	0.4492	0.3053	0.3472	0.5814	0.8363	0.9397	0.9675	(89)
MIT 2	19.3797	18.6215	19.0913	19.5842	19.9078	20.0436	20.0739	20.0699	19.9863	19.5449	18.8300	18.5677	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	19.4925	18.7686	19.2264	19.7087	20.0279	20.1642	20.1956	20.1912	20.1054	19.6685	18.9709	18.7105	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4925	18.7686	19.2264	19.7087	20.0279	20.1642	20.1956	20.1912	20.1054	19.6685	18.9709	18.7105	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9574	0.9227	0.8702	0.7718	0.6274	0.4554	0.3151	0.3571	0.5833	0.8207	0.9234	0.9577	(94)
Useful gains	769.6077	840.9423	900.0400	894.7576	775.4640	553.8534	366.5465	384.5110	571.9348	703.1340	717.9168	733.4595	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1563.8216	1427.5465	1309.9796	1112.5745	857.2251	572.7402	370.1118	390.2415	618.1528	933.4521	1221.9188	1493.6139	(97)
Space heating kWh													
	590.8951	394.1980	304.9950	156.8282	60.8303	0.0000	0.0000	0.0000	0.0000	171.3567	362.8814	565.5548	(98a)
Space heating requirement - total per year (kWh/year)												2607.5396	
Solar heating kWh													
	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	590.8951	394.1980	304.9950	156.8282	60.8303	0.0000	0.0000	0.0000	0.0000	171.3567	362.8814	565.5548	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2607.5396	
Space heating per m2											(98c) / (4) =	25.4245	(99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	261.3541	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	590.8951	394.1980	304.9950	156.8282	60.8303	0.0000	0.0000	0.0000	0.0000	171.3567	362.8814	565.5548	(98)
Space heating efficiency (main heating system 1)													
	261.3541	261.3541	261.3541	261.3541	261.3541	0.0000	0.0000	0.0000	0.0000	261.3541	261.3541	261.3541	(210)
Space heating fuel (main heating system)													
	226.0899	150.8291	116.6980	60.0060	23.2750	0.0000	0.0000	0.0000	0.0000	65.5650	138.8466	216.3941	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	273.4260	225.4474	196.4257	136.9306	98.6952	84.8453	81.9195	102.8303	138.1582	195.6167	241.4394	270.2519	(64)
Efficiency of water heater												183.3684	(216)
(217)m	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	(217)
Fuel for water heating, kWh/month													
	149.1129	122.9478	107.1208	74.6751	53.8235	46.2704	44.6748	56.0785	75.3446	106.6796	131.6691	147.3820	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9863	9.0198	9.9863	9.6641	9.9863	9.6641	9.9863	9.9863	9.6641	9.9863	9.6641	9.9863	(231)
Lighting	34.3871	27.5866	24.8387	18.1979	14.0566	11.4844	12.8229	16.6677	21.6497	28.4055	32.0840	35.3429	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-37.8520	-55.9057	-83.1819	-94.8702	-101.4238	-93.1572	-91.8722	-86.4156	-76.3279	-64.1700	-42.2097	-32.3155	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.2345	-27.6742	-59.1643	-95.9018	-134.2590	-138.5565	-136.7793	-113.3584	-80.1352	-42.6759	-17.2001	-9.5983	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	997.7037	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	183.3684	
Water heating fuel used	1115.7792	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)		
mechanical ventilation fans (SFP = 0.1201)	37.5801	(230a)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	117.5801	(231)
Electricity for lighting (calculated in Appendix L)	277.5240	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1727.2394	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)

Appendix Q - special features

Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	781.3475	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	798.1629	17.5600	156.4399	(240)
Space heating - main system 1 (low-rate cost)	199.5407	0.0940	18.7568	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	781.0454	19.6000	153.0849	(245)
Low-rate cost	334.7338	9.4000	31.4650	(246)
Energy for instantaneous electric shower(s)	0.0000	18.5800	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*19.60 + 0.10*9.40)	37.5801	18.5800	6.2541	(249)
Pump for solar water heating	80.0000	18.5800	14.8640	(249)
Energy for lighting (0.90*19.60 + 0.10*9.40)	277.5240	18.5800	51.5640	(250)
Additional standing charges			7.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.7016	18.5800	-159.7326	
PV Unit electricity exported	-867.5378	5.5900	-48.4954	
Total			-208.2279	(252)
Total energy cost			231.2008	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5641	(257)
SAP value		90.8566	
SAP rating (Section 12)		91	(258)
SAP band		B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	798.1629	0.1637	130.6551	(261)
Space heating - main system 1 (low-rate cost)	199.5407	0.1374	27.4216	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	781.0454	0.1529	119.3936	(264)
Water heating - low rate cost	334.7338	0.1283	42.9478	(264)
Space and water heating			320.4180	(265)
Pumps, fans and electric keep-hot	117.5801	0.1432	16.6707	(267)
Energy for lighting	277.5240	0.1490	41.3566	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-859.7016	0.1387	-119.2665	
PV Unit electricity exported	-867.5378	0.1237	-107.3171	
Total			-226.5836	(269)
Total CO2, kg/year			151.8617	(272)
CO2 emissions per m2			1.4800	(273)
EI value			98.6209	
EI rating			99	(274)
EI band			A	

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Main dwelling						
Ground floor	51.2800	(1b) x	2.4000	(2b) =	123.0720	(1b) - (3b)
First floor	51.2800	(1c) x	2.6000	(2c) =	133.3280	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		256.4000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)

												Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2000	(18)
Number of sides sheltered												2	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.1700	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate													
	0.1955	0.1785	0.1742	0.1700	0.1785	0.1573	0.1658	0.1573	0.1573	0.1700	0.1658	0.1742	(22b)

Mechanical extract ventilation - decentralised

If mechanical ventilation	0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000	(23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K	
Main dwelling	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
Front Door			1.9600	1.4000	2.7440			(26a)
Windows			19.5900	0.6998	13.7100			(27)
Heatloss Floor 1			51.7800	0.1100	5.6958	75.0000	3883.5000	(28a)
External Wall 1	102.5000	21.5500	80.9500	0.1800	14.5710	60.0000	4857.0000	(29a)
External Roof 1	51.2800		51.2800	0.0900	4.6152	9.0000	461.5200	(30)
Total net area of external elements Aum(A, m2)			205.5600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.3360			(33)
Main dwelling								
Party Wall 1			44.0000	0.0000	0.0000	70.0000	3080.0000	(32)
Internal Wall 1			162.7200			9.0000	1464.4800	(32c)
Internal Floor 1			51.7800			18.0000	932.0400	(32d)
Internal Ceiling 1			51.2800			9.0000	461.5200	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15140.0600	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	147.6215	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E10 Eaves (insulation at ceiling level)	8.8000	0.0980	0.8624
E12 Gable (insulation at ceiling level)	11.8000	0.0970	1.1446
P1 Party wall - Ground floor	8.8000	0.3200	2.8160
P2 Party wall - Intermediate floor within a dwelling	8.8000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.8000	0.4800	4.2240
E1 Steel lintel with perforated steel base plate	10.8300	0.5000	5.4150
E3 Sill	9.9000	0.0450	0.4455
E4 Jamb	35.7000	0.0510	1.8207
E5 Ground floor (normal)	20.5000	0.0670	1.3735
E6 Intermediate floor within a dwelling	20.5000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0570	0.5700
E18 Party wall between dwellings	10.0000	0.0620	0.6200

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	19.2917	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	60.6277	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	42.3060	(38)
Heat transfer coeff													
	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	102.9337	(39)
Average = Sum(39)m / 12 =												102.9337	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	1.0036	(40)
HLP (average)												1.0036	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7620	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers													
	70.5294	69.4694	67.9249	64.9698	62.7890	60.3569	58.9746	60.5074	62.1876	64.7989	67.8175	70.2591	(42a)
Hot water usage for baths													
	30.4532	30.0009	29.3640	28.1897	27.3104	26.3353	25.8087	26.4411	27.1297	28.1730	29.3715	30.3502	(42b)
Hot water usage for other uses													
	42.9156	41.3550	39.7944	38.2339	36.6733	35.1127	35.1127	36.6733	38.2339	39.7944	41.3550	42.9156	(42c)
Average daily hot water use (litres/day)												132.2747	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	143.8981	140.8253	137.0834	131.3933	126.7726	121.8050	119.8960	123.6218	127.5512	132.7664	138.5441	143.5249	(44)
Energy conte	227.8994	200.5334	210.6920	179.8709	170.6603	149.7735	145.0038	153.0696	157.2834	180.1627	197.3814	224.7253	(45)
Energy content (annual)										Total = Sum(45)m =		2197.0559	
Distribution loss (46)m = 0.15 x (45)m													
	34.1849	30.0800	31.6038	26.9806	25.5990	22.4660	21.7506	22.9604	23.5925	27.0244	29.6072	33.7088	(46)
Water storage loss:													
Store volume												210.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7182	(55)
Total storage loss													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(56)
If cylinder contains dedicated solar storage													
	22.2642	20.1096	22.2642	21.5460	22.2642	21.5460	22.2642	22.2642	21.5460	22.2642	21.5460	22.2642	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.4260	241.6542	254.8229	217.1753	203.3926	181.2248	177.5035	186.4998	195.9386	224.2936	241.4394	270.2519	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)

PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.8000	(H2)
Collector linear heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0000	(H4)
Collector loop efficiency												0.9000	(H5)
Incidence angle modifier												1.0000	(H6)
Overshading factor												0.8000	(H8)
Overall heat loss coefficient of system												6.5000	(H10)
Heat loss coefficient of collector loop												3.9667	(H11)
Dedicated solar storage volume												75.0000	(H12)
Effective solar volume												75.0000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.3161	(H16)
Heat delivered to hot water												782.3130	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												782.3130	
Solar input	-6.3588	-24.0075	-69.9517	-96.2296	-118.1171	-116.3165	-115.7098	-103.9720	-76.2434	-44.7660	-10.6405	-0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	267.0672	217.6467	184.8712	120.9457	85.2755	64.9082	61.7937	82.5277	119.6952	179.5276	230.7990	270.2519	(64)
									Total per year (kWh/year) = Sum(64)m =			1885.3095	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	112.1978	99.5740	105.3598	89.6506	82.9304	74.9607	74.2135	77.6398	83.2208	95.2088	100.8757	111.1424	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	165.7196	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.2864	34.8938	28.3776	21.4836	16.0593	13.5579	14.6498	19.0424	25.5586	32.4526	37.8769	40.3783	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	388.6584	392.6915	382.5283	360.8921	333.5803	307.9110	290.7624	286.7293	296.8925	318.5287	345.8405	371.5098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	54.3340	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	-110.4798	(71)
Water heating gains (Table 5)	150.8035	148.1756	141.6126	124.5147	111.4656	104.1121	99.7493	104.3545	115.5845	127.9688	140.1052	149.3850	(72)
Total internal gains	688.3222	685.3347	662.0923	616.4643	570.6790	535.1549	514.7354	519.7001	547.6095	588.5239	633.3965	670.8469	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	12.2400	26.6540	0.3900	0.0000	0.7700	97.9715	(76)
West	7.3500	26.6540	0.3900	0.0000	0.7700	58.8309	(80)

Solar gains	156.8024	258.7564	419.4885	624.8523	737.0071	806.2193	770.9813	665.7561	522.6721	327.2259	188.3280	128.5730	(83)
Total gains	845.1246	944.0912	1081.5808	1241.3167	1307.6861	1341.3742	1285.7166	1185.4561	1070.2816	915.7498	821.7245	799.4199	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	40.8571	
alpha	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	3.7238	
util living area	0.9552	0.9346	0.8765	0.7545	0.5828	0.3911	0.2628	0.2846	0.5201	0.7928	0.9227	0.9604	(86)
Living	19.6987	19.8857	20.2729	20.6685	20.9012	20.9829	20.9972	20.9963	20.9517	20.6776	20.1496	19.6683	
Non living	18.5914	18.8232	19.2956	19.7545	19.9997	20.0706	20.0794	20.0792	20.0491	19.7789	19.1564	18.5543	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.3343	19.8857	20.2729	20.6685	20.9012	20.9829	20.9972	20.9963	20.9517	20.6776	20.1496	19.8545	(87)
Th 2	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	20.0803	(88)
util rest of house	0.9469	0.9229	0.8554	0.7171	0.5275	0.3249	0.1902	0.2062	0.4456	0.7488	0.9060	0.9528	(89)
MIT 2	19.4867	18.8232	19.2956	19.7545	19.9997	20.0706	20.0794	20.0792	20.0491	19.7789	19.1564	18.8293	(90)
Living area fraction										fLA = Living area / (4) =		0.1334	(91)
MIT	19.5998	18.9649	19.4260	19.8765	20.1199	20.1923	20.2019	20.2015	20.1695	19.8988	19.2889	18.9661	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5998	18.9649	19.4260	19.8765	20.1199	20.1923	20.2019	20.2015	20.1695	19.8988	19.2889	18.9661	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9418	0.9053	0.8380	0.7081	0.5299	0.3331	0.1999	0.2166	0.4531	0.7391	0.8884	0.9411	(94)
Useful gains	795.9604	854.7254	906.3451	878.9529	693.0006	446.8574	257.0080	256.8035	484.9770	676.8430	729.9991	752.3402	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.7000	15.3000	12.0000	8.5000	5.5000	(96)
Heat loss rate W	1471.9293	1365.4030	1237.8774	1026.9126	732.8807	452.1117	257.5251	257.4880	501.2361	813.0488	1110.5401	1386.1105	(97)
Space heating kWh	502.9208	343.1753	246.6600	106.5310	29.6708	0.0000	0.0000	0.0000	0.0000	101.3371	273.9895	471.5251	(98a)
Space heating requirement - total per year (kWh/year)												2075.8096	
Solar heating kWh	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(98b)

Solar heating contribution - total per year (kWh/year) 0.0000

Space heating kWh

502.9208	343.1753	246.6600	106.5310	29.6708	0.0000	0.0000	0.0000	0.0000	101.3371	273.9895	471.5251	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 2075.8096

Space heating per m2 (98c) / (4) = 20.2400 (99)

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)

Fraction of space heat from main system(s) 1.0000 (202)

Efficiency of main space heating system 1 (in %) 261.3541 (206)

Efficiency of main space heating system 2 (in %) 0.0000 (207)

Efficiency of secondary/supplementary heating system, % 0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	502.9208	343.1753	246.6600	106.5310	29.6708	0.0000	0.0000	0.0000	0.0000	101.3371	273.9895	471.5251	(98)
Space heating efficiency (main heating system 1)													
	261.3541	261.3541	261.3541	261.3541	261.3541	0.0000	0.0000	0.0000	0.0000	261.3541	261.3541	261.3541	(210)
Space heating fuel (main heating system)													
	192.4289	131.3066	94.3777	40.7612	11.3527	0.0000	0.0000	0.0000	0.0000	38.7739	104.8346	180.4162	(211)
Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	267.0672	217.6467	184.8712	120.9457	85.2755	64.9082	61.7937	82.5277	119.6952	179.5276	230.7990	270.2519	(64)
Efficiency of water heater												183.3684	(216)
(217)m	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	183.3684	(217)
Fuel for water heating, kWh/month													
	145.6451	118.6937	100.8195	65.9578	46.5050	35.3977	33.6992	45.0065	65.2758	97.9054	125.8663	147.3820	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9863	9.0198	9.9863	9.6641	9.9863	9.6641	9.9863	9.9863	9.6641	9.9863	9.6641	9.9863	(231)
Lighting	34.3871	27.5866	24.8387	18.1979	14.0566	11.4844	12.8229	16.6677	21.6497	28.4055	32.0840	35.3429	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-47.8323	-60.8549	-88.5813	-100.9650	-104.9971	-100.0643	-98.8302	-93.8343	-84.3434	-71.8537	-51.0367	-40.8716	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-18.8375	-33.1668	-69.6789	-116.7601	-154.8114	-173.2800	-171.9449	-143.3322	-102.3936	-56.4127	-25.1695	-14.7385	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 794.2518 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 183.3684

Water heating fuel used 1028.1540 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 3.4840, total flow = 29.0000, SFP = 0.1201)

mechanical ventilation fans (SFP = 0.1201) 37.5801 (230a)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 117.5801 (231)

Electricity for lighting (calculated in Appendix L) 277.5240 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation -2024.5910 (233)

Wind generation 0.0000 (234)

Hydro-electric generation (Appendix N) 0.0000 (235a)

Electricity generated - Micro CHP (Appendix N) 0.0000 (235)

Appendix Q - special features

Energy saved or generated -0.0000 (236)

Energy used 0.0000 (237)

Total delivered energy for all uses 192.9189 (238)

10a. Fuel costs - using BEDF prices (572)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1 (high-rate cost)	635.4014	27.8600	198.2452	(240)
Space heating - main system 1 (low-rate cost)	158.8504	0.1450	23.0333	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (electric off-peak tariff)				
High-rate fraction			0.7000	(243)
Low-rate fraction			0.3000	(244)
High-rate cost	719.7078	31.2000	224.5488	(245)
Low-rate cost	308.4462	14.5000	44.7247	(246)
Energy for instantaneous electric shower(s)	0.0000	29.5300	0.0000	(247a)
Pumps, fans and electric keep-hot (0.90*31.20 + 0.10*14.50)	37.5801	29.5300	9.9050	(249)
Pump for solar water heating	80.0000	29.5300	23.6240	(249)
Energy for lighting (0.90*31.20 + 0.10*14.50)	277.5240	29.5300	81.9528	(250)
Additional standing charges			3.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-944.0648	29.5300	-278.7823	
PV Unit electricity exported	-1080.5261	5.8100	-62.7786	
Total			-341.5609	(252)
Total energy cost			267.4730	(255)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1 (high-rate cost)	635.4014	0.1647	104.6402	(261)
Space heating - main system 1 (low-rate cost)	158.8504	0.1382	21.9602	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating - high rate cost	719.7078	0.1542	110.9587	(264)
Water heating - low rate cost	308.4462	0.1294	39.9151	(264)
Space and water heating			277.4742	(265)
Pumps, fans and electric keep-hot	117.5801	0.1432	16.6707	(267)
Energy for lighting	277.5240	0.1490	41.3566	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-944.0648	0.1392	-131.4180	
PV Unit electricity exported	-1080.5261	0.1238	-133.7445	
Total			-265.1625	(269)
Total CO2, kg/year			70.3390	(272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1 (high-rate cost)	635.4014	1.2910	1025.3468	(275)
Space heating - main system 1 (low-rate cost)	158.8504	1.5008	238.4033	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating - high rate cost	719.7078	1.5756	1133.9609	(278)
Water heating - low rate cost	308.4462	1.4654	451.9913	(278)
Space and water heating			2849.7023	(279)
Pumps, fans and electric keep-hot	117.5801	1.5335	179.5358	(281)
Energy for lighting	277.5240	1.5547	431.4789	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-944.0648	1.5189	-1433.9316	
PV Unit electricity exported	-1080.5261	0.4541	-490.7111	
Total			-1924.6427	(283)
Total Primary energy kWh/year			1536.0743	(286)

APPENDIX B – Part G Water Calculation

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PART G - WATER EFFICIENCY CALCULATOR

Project Ref:	
Project Name:	Havant
Date:	22.06.2025
Assessor:	Naomi Sadler
Notes:	

Table A1: The water efficiency calculator

			(1)	(2)	(3)	(4)
Installation type	**Unit of measure**		**Capacity/ flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/person/day = [(1) (2)] + (3)**
WCs (multiple fittings)	Average effective flushing volume (litres)		3.06	4.42	0.00	13.53
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)		4.00	1.58	1.58	7.90
Bath (where shower also present)	Capacity to overflow (litres)		160.00	0.11	0.00	17.60
Shower (where bath also present)	Flow rate (litres/minute)		8.00	4.37	0.00	34.96
Bath only	Capacity to overflow (litres)		0.00	0.50	0.00	0.00
Shower only	Flow rate (litres/minute)		0.00	5.60	0.00	0.00
Kitchen/utility room sink taps	Flow rate (litres/minute)		8.00	0.44	10.36	13.88
Washing machine	Litres/kg dry load	**Washing machine installed?** No	8.17	2.10	0.00	17.16
Dishwasher	Litres/place setting	**Dishwasher installed?** No	1.25	3.60	0.00	4.50
Waste disposal unit	Litres/use **(If present = 1, If absent = 0)**	**Waste disposal installed?** No	0.00	3.08	0.00	0.00
Water softener	Litres/person/day	**Water softener installed?** No	0.00	1.00	0.00	0.00
	(5)		Total calculated use = (Sum column 4)			109.53104
	(6)	**Greywater Harvesting installed?** No	Contribution from greywater (litres/person/day) from Table 4.6			0.00
	(7)	**Rainwater Hervesting installed?** No	Contribution from rainwater (litres/person/day) from Table 5.5			0.00
	(8)		Normalisation factor			0.91
	(9)		**Total Internal Water Consumption** = [(5) – (6) – (7)] = (8) **(CSH)**			**99.7**
	(10)		External water use			5
	(11)		**Total water consumption (including external use)** = (9) + (10) (litres/person/day) **(Part G)**			**104.7**

This calculation sheet has been developed in accordance with the methodology stated within Building Regulations Approved Document G 2015 (2016 Amendments) Appendix A. Please refer to this document for specific guidance of how flow rates are to be derived.



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