45 Hulbert Road Bedhampton

ENERGY STATEMENT AND PART O COMPLIANCE

Greenbox Associates

February 2026 V3

PROJECT DETAILS

Project Name: 45 Hulbert Road Bedhampton

Client: Sonja Jones

Report: Energy Statement

Date: **February 2026**

Version: **3**

Status: **FINAL**

GREENBOX ASSOCIATES

This report was prepared by Dr Rachel Mitchell of Greenbox Associates Ltd, an architectural engineering consultancy which specialises in building modelling and energy demand reduction. Rachel Mitchell is a Certified Passivhaus Consultant, Elmhurst Energy OCDEA SAP assessor and thermal bridge modeller.

This report has been prepared by Greenbox Associates Ltd using all reasonable skill, care and diligence and using evidence supplied by the design team and client.

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ENERGY STRATEGY SUMMARY

Greenbox Associates Ltd has been appointed by Sonja Jones to provide an energy statement which details the design elements of the proposed new detached bungalow at 45 Hulbert Road Bedhampton to show compliance with AD L Volume 1 Dwellings 2021 and AD Part O Overheating. The dwelling has been modelled in SAP 10 software and assessed for overheating using the simplified method.

This energy statement is guided by the following planning documents.

- Havant Borough Council Adopted Core Strategy 2011

And refers to.

- The draft Building a Better Future document (unadopted)

The Energy Strategy will be directed by the core principles of the energy hierarchy.

1. Be Lean: use less energy.
2. Be Clean: supply energy efficiently.
3. Be Green: use low carbon or renewable energy.

The dwelling has been designed to be energy efficient and reduce carbon emissions on site. The dwelling complies with Approved Document L Volume 1 Dwellings 2021 and Approved Document Part O 2010 Overheating.

The key sustainable design features of 45 Hulbert Road are.

- Low U values to reduce heat losses.
- Good quality double glazing
- Natural ventilation when needed
- Low carbon heating and hot water from a heat pump
- Rationalised glazing design
- Cross ventilation and night ventilation

Which will deliver?

- Overall carbon emissions reduction greater than 60% for regulated energy use
- Reduction of regulated carbon emissions from the building fabric beyond 9%
- Management of overheating risk

1 INTRODUCTION

This energy statement sets out the design and construction measures to be followed to ensure the delivery of a high quality, low energy, sustainable development at 45 Hulbert Road Bedhampton Hampshire.

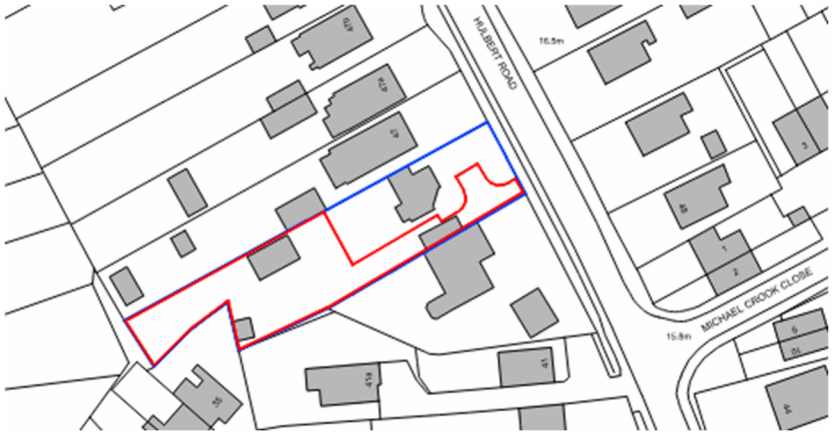
1.1 DEVELOPMENT OVERVIEW

The planning application is for the development of single detached two-bedroom bungalow.

1.2 SITE LOCATION

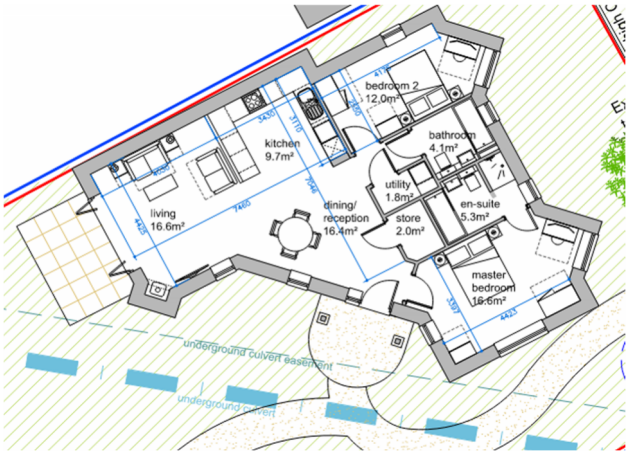
The site is located on the rear garden of 45 Hulbert Road

Figure 1 Site location and site plan



1.3 PROPOSED DEVELOPMENT

The proposed development is for a detached bungalow



2 PLANNING POLICY

2.1 HAVANT BOROUGH COUNCIL CORE STRATEGY 2011

Policy CS14 Efficient Use of Resources, refers to the Code for Sustainable Homse, which has now been withdrawn, and level 3 typically would be a 25% improvement in predicted carbon emissions over AD L Volume 1 Dwellings of Building Regulations.

- It is proposed to exceed this percentage improvement.

2.2 DRAFT BUILDING A BETTER FUTURE PLAN

Whilst this Plan is not adopted, there are key elements within this, which are considered for this development

Policy 8 Health and Climate Change refers to minimising greenhouse gasses from buildings and their use and taking opportunities to incorporate low carbon and renewable technologies wherever possible

- Heating and hot water will be provided in the proposed development by a low carbon air source heat pump, fuelled by a rapidly decarbonising National Grid

Policy 15: Low Cabron development refers to moving to a low carbon economy and to deliver radical reductions in carbon emissions.

- By moving away from fossil fuels and all electric heating and hot water, the carbon emissions associated with this development are considerably reduced.

The policy also refers to the energy hierarchy of:

Minimise energy demand: Reduce energy consumption by talking a fabric first approach The dwelling has been designed to exceed the challenging building fabric element of Part L 2021 using improved U values and air tightness.

Maximise energy efficiency: A good quality heat pump can deliver a seasonal co-efficient of performance (SCOP) of between 300% and 400%.

Utilise renewable energy: It is not proposed to use on-site renewable energy at this development, as all energy used on site will be provided by the decarbonising National Grid

Utilise low carbon energy: A low carbon all electric heat pump will be installed

3 SUSTAINABLE CONSTRUCTION

The following specification is proposed as 45 Hulbert Road in Table 1 and is compared to the baseline requirements of compliance with AD L Volume 1 Dwellings.

45 Hulbert Road specification		
Element	**Proposed Specification**	**Part L 2021 limiting U values**
External Wall	0.016 W/m^{2}K 190mm Cavity full fil ʎ = 0.032 W/mK	**0.26 W/m^{2}K**
Floor	0.12 W/m^{2}K 150mm Celotex or similar ʎ = 0.022 W/mK	**0.18 W/m^{2}K**
Roof	0.12 W/m^{2}K 100mm Celotex or similar ʎ = 0.022 W/mK between rafters plus 100mm below	**0.16 W/m^{2}K**
Air tightness	Target 4m^3/hm^2 @50Pa	**8m^3/hm^2 @50Pa**
Double Glazing	Whole window U value less than 1.3 W/m^{2}K	**1.6 W/m^{2}K**
New Doors	1.3 W/m^{2}K	**1.6 W/m^{2}K**
Thermal bridges	Recognised Construction details https://www.recognisedconstructiondetails.co.uk/home	
Space heating	Air Source Heat Pump Mitsubishi Ecodan 5.0 kW heat pump.	**Compliance with Part L will be based on a gas**
Emitters	Underfloor heating and radiators	-
Hot Water	From main heating system (ASHP)	-
Controls	Space heating: Programmer, room thermostat and TRVs Hot water; Cylinder Stat and independent time controls	-
Ventilation	Intermittent extract fans	-

Table 1. Summary of the specification at 45 Hulbert Road Bedhampton

This specification will deliver the following outputs from a SAP 10 assessment (See appendix 1 for the summary sheet)

45 Hulbert Road SAP 10 Outputs						
	Target Emission Rate (TER)	**Dwelling Emission Rate (DER)**	**Target Primary Energy Rate (TPER)**	**Dwelling Primary Energy Rate (DPER)**	**Target Fabric Energy Efficiency (TFEE)**	**Dwelling Fabric Energy Efficiency (DFEE)**
Output	12.34	4.9	66.42	50.99	58.48	53.16
Improvement		**60.29%**		**23.23%**		**9.10%**

Table 2 Summary of the SAP 10 Outputs for 45 Hulbert Road Bedhampton

We can see from Table 2, that the Dwelling Emission Rate (DER) exceeds the Target Emission Rate (TER) by 60.29% and there is a 9.31% improvement in Fabric Energy Efficiency (DFEE) compared to the minimum requirements of AD L Volumes 1 Dwellings 2021. This is achieved by the following fabric and building services improvements.

- Low U values to the building fabric
- Good quality double glazing
- Reduced heat losses at key junctions to reduce thermal bridging
- Higher levels of air tightness to further reduce heat losses
- Low carbon and efficient air source heat pump

4 PART O OVERHEATING RISK

Approved Document Part O (Overheating), introduced in June 2022, and requires all new residential buildings in England to limit unwanted solar gains and provide adequate means for removing excess heat. The purpose of Part O is to prevent new homes form becoming uncomfortably hot during warmer months. Overheating risk should be managed by the following mitigation measures.

- **Limiting solar gains**, by rationalising glazing area, using low g glass and external blinds if needed
- **Removing excess heat,** by ensuing adequate, safe ventilation though openable windows and if necessary, using mechanical cooling
- **Safety Considerations**, Compliance must account for user safety, such as security for ground floor windows and protection from falling

4.1 SIMPLIFIED METHOD

The simplified method can be applied to show compliance with Part O and is based on the following elements

Location Risk Assessment: Determines if the building is in a moderate-risk (rest of England) or high-risk (parts of London) area, which influences the strictness of the required limits.

Glazing Limits: Prescribes maximum permitted glazed areas on the south, west, and east facades to reduce solar gain. The glazing area is shown as a percentage of the floor area for each room.

Liming solar gains Solar gain can also be limited by the ‘g’ value of glass, the lower the g value, the lower the solar gains.

Shading Requirements: Mandatory for high-risk locations, requiring features like shutters, blinds, or overhangs to block direct sunlight.

Minimum Free Areas (Ventilation): Defines the necessary openable window area to allow for sufficient cross-ventilation, with stricter requirements for single-aspect dwellings.

Rules for Compliance: The design must adhere to specific checklists rather than flexible modelling, often limiting design freedom.

This method is suitable for typical, residential designs, but is unsuitable for, buildings with high, noise levels, poor air quality, or complex, communal heating, which require, dynamic, thermal, modelling.

The dwelling at 45 Hulbert Road is suitable for demonstrating compliance using the Simplified Method with the following design considerations.

4.2 PART O COMPLIANCE 45 HULBERT ROAD

The following design features are used in the assessment of overheating risk for 45 Hulbert Road

- The dwelling is in a moderate risk location
- The g value of the glass is assumed to be 0.72 which could be reduced if needed
- All windows are side hung and openable except for the fixed window by the front door and the centre window in Bedroom 1
- Bedrooms windows (which are all on the ground floor) will be restricted for safety, but are openable at night
- Optimising the glazing areas to allow good daylighting but not oversize to increase solar gains
- Cross ventilation – where windows on opposite sides of the dwelling can opened to allow a crossflow air movement

This specification gives the following outputs using the Simplified Method

Building Regulations Part O 2021 (England), Simplified Method - Results

	Is dwelling in a location where external noise may be an issue?	**No**
	Is dwelling located near to significant local pollution sources?	**No**
	Direction of house type plan 'clock face 6' on site wide plan	**South**

A	**Site data**									
	Company	Greenbox Associates Ltd								
	Site	45 Hulbert Road								
	House type	Detached Bungalow								
	Plot number									
B	**Home data**									
	Location risk category	**Moderate Risk**								
	Shading provided?	**None**								
	Cross ventilation?	**Yes**								
	Total GIA of home (m^2)	**89.47**								
	Largest glazed façade orientation	**South**								
C	**Results**	**Value**		**Percentage**		**Target**		**RESULT**	✓✗	
	Limiting solar gains:									
	Total glazing area for home	13.01	m^2	14.55	%	15	%	Target met	✓	
	Glazing area for most glazed room: **Living/ Kitchen/ Dining**	5.81	m^2	14.52	%	30	%	Target met	✓	
	Shading	None				Not required			✓	
	Removal of excess heat:									
	Total equivalent area (% of floor area)	14.54	m^2	16.25	%	9	%	Target met	✓	
	Total equivalent area (% of glazed area)	14.54	m^2	111.74	%	55	%	Target met	✓	
	Bedroom 1 equivalent area	1.03	m^2	6.06	%	4	%	Target met	✓	
	Bedroom 2 equivalent area	0.64	m^2	5.37	%	4	%	Target met	✓	

The dwelling at 45 Hulbert Road Complies with Part O using the simplified method. See appendix 2.

5 SUMMARY AND CONCLUSION

The proposed bungalow at 45 Hulbert Road has been designed to exceed the percentage uplift of Dwelling Emission Rate (DER) over target Emission Rate (TER) by over 60% as this is seen in Table 3 Below. In addition, the building design will exceed the fabric requirements of AD L Volume 1 dwellings by nearly 10%

45 Hulbert Road SAP 10 Outputs						
	Target Emission Rate (TER)	Dwelling Emission Rate (DER)	Target Primary Energy Rate (TPER)	Dwelling Primary Energy Rate (DPER)	Target Fabric Energy Efficiency (TFEE)	Dwelling Fabric Energy Efficiency (DFEE)
Output	12.34	4.9	66.42	50.99	58.48	53.16
Improvement		**60.29%**		**23.23%**		**9.10%**

Table 3. Summary of outputs from SAP 10 for 45 Hulbert Road

Management of overheating risk has also been considered, and the dwelling will meet the requirements of Part O Overheating, and the summary has been given within this report.

6 APPENDIX ONE: SAP 10 OUTPUT

Full SAP Calculation Printout

Plot Reference	45 Hulbert Road	**Issued on Date**	25/02/2026
Assessment Reference	without PV	**Plot Type Ref**	Bungalow
Plot Address	45, Hulbert Road , Havant, Hampshire , PO9 3TA	**SAP Version**	10.2

SAP Rating	79 C	**DER**	4.90	**TER**	12.34
Environmental	96 A	**% DER < TER**			60.29
CO_2 Emissions (t/year)	0.39	**DFEE**	53.16	**TFEE**	58.48
Compliance Check	See BREL	**% DFEE < TFEE**			9.10
% DPER < TPER	23.23	**DPER**	50.99	**TPER**	66.42

Assessor Details	Dr. Rachel Mitchell	**Assessor ID**	L772-0001
Client			

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	90.0000 (1b)	x	3.7300 (2b)	=	335.7000	(1b) - (3b) (4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	335.7000	(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) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3192	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3192	(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	0.4069	0.3989	0.3910	0.3511	0.3431	0.3032	0.3032	0.2952	0.3192	0.3431	0.3590	0.3750	(22b)
Effective ac	0.5828	0.5796	0.5764	0.5616	0.5589	0.5460	0.5460	0.5436	0.5509	0.5589	0.5645	0.5703	(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								
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200
E3 Sill	11.8000	0.0220	0.2596
E4 Jamb	33.6000	0.0170	0.5712
E5 Ground floor (normal)	45.0000	0.0700	3.1500
E16 Corner (normal)	21.6000	0.0420	0.9072
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840

R3 Jamb of roof window									3.9200	0.2400	0.9408		
E17 Corner (inverted - internal area greater than external area)									21.6000	-0.0850	-1.8360		
E11 Eaves (insulation at rafter level)									45.0000	0.0180	0.8100		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												5.8908	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		74.4122	(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	64.5623	64.2062	63.8571	62.2174	61.9106	60.4824	60.4824	60.2180	61.0325	61.9106	62.5312	63.1800	(38)
Heat transfer coeff	138.9745	138.6184	138.2693	136.6296	136.3228	134.8946	134.8946	134.6302	135.4447	136.3228	136.9434	137.5922	(39)
Average = Sum(39)m / 12 =												136.6281	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5442	1.5402	1.5363	1.5181	1.5147	1.4988	1.4988	1.4959	1.5049	1.5147	1.5216	1.5288	(40)
HLP (average)												1.5181	
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												2.6257	(42)
Hot water usage for mixer showers	85.3056	84.0236	82.1555	78.5812	75.9435	73.0020	71.3300	73.1840	75.2162	78.3746	82.0256	84.9787	(42a)
Hot water usage for baths	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												143.7182	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.2961	153.0667	149.0724	142.8519	137.8534	132.4585	130.2769	134.2527	138.4612	144.1390	150.4596	155.8697	(44)
Energy conte	247.5349	217.9649	229.1188	195.5571	185.5772	162.8732	157.5586	166.2329	170.7365	195.5952	214.3573	244.0542	(45)
Energy content (annual)										Total = Sum(45)m =		2387.1608	
Distribution loss (46)m = 0.15 x (45)m	37.1302	32.6947	34.3678	29.3336	27.8366	24.4310	23.6338	24.9349	25.6105	29.3393	32.1536	36.6081	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6588	(55)
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(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	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(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	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
										Total per year (kWh/year) = Sum(64)m =		2901.5188	(64)
12Total per year (kWh/year)												2902	(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	117.2535	104.0394	111.1301	98.8435	96.6526	87.9761	87.3364	90.2206	90.5907	99.9836	105.0946	116.0962	(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	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.9173	133.8727	120.9173	124.9479	120.9173	124.9479	120.9173	120.9173	124.9479	120.9173	124.9479	120.9173	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(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)	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)	157.5988	154.8206	149.3685	137.2827	129.9094	122.1891	117.3876	121.2642	125.8204	134.3865	145.9647	156.0433	(72)
Total internal gains	579.9797	592.6377	567.9785	546.6141	518.4097	498.9299	479.5491	480.9448	495.7833	513.6281	546.0373	567.8754	(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	
Northeast	1.4700	11.2829	0.7200	0.7000	0.7700	5.7930	(75)
East	3.0000	19.6403	0.7200	0.7000	0.7700	20.5794	(76)
Southeast	2.8800	36.7938	0.7200	0.7000	0.7700	37.0110	(77)
South	2.3100	46.7521	0.7200	0.7000	0.7700	37.7204	(78)
Southwest	6.5100	36.7938	0.7200	0.7000	0.7700	83.6604	(79)
Northwest	0.8400	11.2829	0.7200	0.7000	0.7700	3.3103	(81)
Northwest	1.5700	26.0000	0.7200	0.7000	1.0000	18.5160	(82)

Solar gains	206.5905	364.5682	527.9823	695.7523	811.9284	818.9928	784.3175	696.6040	586.4123	411.2222	249.8635	175.1764	(83)
Total gains	786.5701	957.2059	1095.9607	1242.3664	1330.3381	1317.9227	1263.8666	1177.5488	1082.1956	924.8503	795.9008	743.0518	(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	17.9889	18.0351	18.0807	18.2977	18.3388	18.5330	18.5330	18.5694	18.4577	18.3388	18.2557	18.1696	
alpha	2.1993	2.2023	2.2054	2.2198	2.2226	2.2355	2.2355	2.2380	2.2305	2.2226	2.2170	2.2113	
util living area													
	0.9368	0.9052	0.8602	0.7809	0.6729	0.5373	0.4193	0.4583	0.6385	0.8201	0.9104	0.9434	(86)
Living	19.7950	19.9037	20.0549	20.2450	20.4013	20.5126	20.5588	20.5511	20.4672	20.2571	19.9960	19.7802	
Non living	18.5387	18.6470	18.7957	18.9879	19.1317	19.2354	19.2672	19.2656	19.1985	19.0069	18.7521	18.5346	
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	20.3836	19.9037	20.0549	20.2450	20.4013	20.5126	20.5588	20.5511	20.4672	20.2571	19.9960	19.9508	(87)
Th 2	19.6545	19.6575	19.6604	19.6739	19.6765	19.6884	19.6884	19.6906	19.6838	19.6765	19.6713	19.6660	(88)
util rest of house													
	0.9267	0.8905	0.8381	0.7456	0.6178	0.4548	0.3106	0.3487	0.5608	0.7827	0.8939	0.9342	(89)
MIT 2	19.0837	18.6470	18.7957	18.9879	19.1317	19.2354	19.2672	19.2656	19.1985	19.0069	18.7521	18.6929	(90)
Living area fraction										fLA = Living area / (4) =		0.4778	(91)
MIT	19.7048	19.2474	19.3973	19.5885	19.7383	19.8456	19.8843	19.8798	19.8047	19.6042	19.3464	19.2939	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7048	19.2474	19.3973	19.5885	19.7383	19.8456	19.8843	19.8798	19.8047	19.6042	19.3464	19.2939	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9271	0.8853	0.8333	0.7431	0.6207	0.4654	0.3279	0.3658	0.5687	0.7804	0.8893	0.9313	(94)
Useful gains	729.2220	847.4594	913.2138	923.1654	825.6799	613.4202	414.4532	430.7182	615.4985	721.7398	707.7704	692.0090	(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													
	2140.8698	1988.8198	1783.3041	1460.3697	1095.7982	707.6003	443.0358	468.4863	772.6692	1227.4817	1677.0672	2076.8009	(97)
Space heating kWh													
	1050.2659	766.9942	647.3472	386.7871	200.9680	0.0000	0.0000	0.0000	0.0000	376.2720	697.8937	1030.2852	(98a)
Space heating requirement - total per year (kWh/year)												5156.8132	
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													
	1050.2659	766.9942	647.3472	386.7871	200.9680	0.0000	0.0000	0.0000	0.0000	376.2720	697.8937	1030.2852	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5156.8132	
Space heating per m2											(98c) / (4) =	57.2979	(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 %)	310.3961	(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													
	1050.2659	766.9942	647.3472	386.7871	200.9680	0.0000	0.0000	0.0000	0.0000	376.2720	697.8937	1030.2852	(98)
Space heating efficiency (main heating system 1)													
	310.3961	310.3961	310.3961	310.3961	310.3961	0.0000	0.0000	0.0000	0.0000	310.3961	310.3961	310.3961	(210)
Space heating fuel (main heating system)													
	338.3631	247.1017	208.5552	124.6108	64.7457	0.0000	0.0000	0.0000	0.0000	121.2232	224.8397	331.9259	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
Efficiency of water heater												271.6210	(216)
(217)m	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	(217)
Fuel for water heating, kWh/month													
	107.2156	94.7727	100.4355	87.5607	84.4053	75.5277	74.0899	77.2834	78.4227	88.0935	94.4821	105.9342	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.2192	22.6385	20.3835	14.9338	11.5353	9.4244	10.5229	13.6780	17.7664	23.3105	26.3292	29.0035	(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	1661.3652	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	271.6210	
Water heating fuel used	1068.2233	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	227.7452	(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	2957.3337	(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	1661.3652	0.1550	257.5052	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1068.2233	0.1411	150.6945	(264)
Space and water heating			408.1997	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	227.7452	0.1443	32.8707	(268)
Total CO2, kg/year			441.0704	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.9000	(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	1661.3652	1.5738	2614.6656	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1068.2233	1.5216	1625.4459	(278)
Space and water heating			4240.1116	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	227.7452	1.5338	349.3232	(282)
Total Primary energy kWh/year			4589.4347	(286)
Dwelling Primary energy Rate (DPER)			50.9900	(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	90.0000	(1b) x	3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		335.7000	(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) =	0.0894	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3394	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3394	(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	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988	(22b)
Effective ac	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795	(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	
TER Semi-glazed door			2.1000	1.0000	2.1000			(26a)
TER Opening Type			17.0100	1.1450	19.4771			(27)
TER Roof Light			1.5700	1.5918	3.1746			(27a)
Heatloss Floor 1			90.0000	0.1300	11.7000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1800	16.0002			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1100	14.6773			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7852			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0500	0.6400
E3 Sill	11.8000	0.0500	0.5900
E4 Jamb	33.6000	0.0500	1.6800
E5 Ground floor (normal)	45.0000	0.1600	7.2000
E16 Corner (normal)	21.6000	0.0900	1.9440
R1 Head of roof window	1.6000	0.0800	0.1280
R2 Sill of roof window	1.6000	0.0600	0.0960
R3 Jamb of roof window	3.9200	0.0800	0.3136
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0900	-1.9440
E11 Eaves (insulation at rafter level)	45.0000	0.0400	1.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.4476 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 81.2328 (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	65.7608	65.3581	64.9634	63.1094	62.7625	61.1478	61.1478	60.8488	61.7698	62.7625	63.4643	64.1979	(38)
Heat transfer coeff	146.9936	146.5909	146.1962	144.3422	143.9954	142.3806	142.3806	142.0816	143.0026	143.9954	144.6971	145.4307	(39)
Average = Sum(39)m / 12 =												144.3406	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6333	1.6288	1.6244	1.6038	1.5999	1.5820	1.5820	1.5787	1.5889	1.5999	1.6077	1.6159	(40)
HLP (average)												1.6038	
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 2.6257 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	68.2445	67.2189	65.7244	62.8650	60.7548	58.4016	57.0640	58.5472	60.1730	62.6997	65.6205	67.9830	(42a)
Hot water usage for baths	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												127.9884	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	139.2350	136.2620	132.6413	127.1357	122.6647	117.8581	116.0109	119.6159	123.4179	128.4640	134.0545	138.8739	(44)
Energy conte	220.5143	194.0352	203.8648	174.0424	165.1303	144.9203	140.3051	148.1094	152.1866	174.3245	190.9852	217.4430	(45)
Energy content (annual)										Total = Sum(45)m =		2125.8611	
Distribution loss (46)m = 0.15 x (45)m	33.0771	29.1053	30.5797	26.1064	24.7695	21.7380	21.0458	22.2164	22.8280	26.1487	28.6478	32.6165	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8381	(55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(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	269.7569	238.5125	253.1074	221.6966	214.3730	192.5745	189.5478	197.3521	199.8408	223.5672	238.6394	266.6857	(62)
WWHRS	-31.1985	-27.5922	-28.8930	-23.9245	-22.2968	-19.0795	-17.8840	-19.0179	-19.7404	-23.2718	-26.3641	-30.6208	(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	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649	(64)
										Total per year (kWh/year) = Sum(64)m =		2415.7703	(64)
12Total per year (kWh/year)												2416	(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	112.7151	100.0985	107.1792	95.9924	94.3000	86.3094	86.0456	88.6405	88.7254	97.3570	101.6259	111.6939	(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	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	120.9173	133.8727	120.9173	124.9479	120.9173	124.9479	120.9173	120.9173	124.9479	120.9173	124.9479	120.9173	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(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)	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)	151.4988	148.9561	144.0580	133.3228	126.7473	119.8741	115.6527	119.1405	123.2297	130.8562	141.1471	150.1263	(72)
Total internal gains	576.8797	589.7733	565.6680	545.6542	518.2476	496.6149	477.8141	478.8211	493.1927	513.0978	544.2198	564.9584	(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	
Northeast	1.4700	11.2829	0.6300	0.7000	0.7700	5.0689	(75)
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(76)
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)
South	2.3100	46.7521	0.6300	0.7000	0.7700	33.0054	(78)
Southwest	6.5100	36.7938	0.6300	0.7000	0.7700	73.2028	(79)
Northwest	0.8400	11.2829	0.6300	0.7000	0.7700	2.8965	(81)
Northwest	1.5700	26.0000	0.6300	0.7000	1.0000	16.2015	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	180.7666	318.9972	461.9845	608.7832	710.4374	716.6187	686.2778	609.5285	513.1107	359.8194	218.6305	153.2793	(83)
Total gains	757.6463	908.7705	1027.6525	1154.4375	1228.6850	1213.2336	1164.0920	1088.3496	1006.3034	872.9172	762.8503	718.2377	(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	17.0075	17.0543	17.1003	17.3199	17.3617	17.5586	17.5586	17.5955	17.4822	17.3617	17.2775	17.1903	
alpha	2.1338	2.1370	2.1400	2.1547	2.1574	2.1706	2.1706	2.1730	2.1655	2.1574	2.1518	2.1460	
util living area	0.9423	0.9158	0.8780	0.8095	0.7122	0.5827	0.4628	0.5017	0.6773	0.8409	0.9191	0.9479	(86)
MIT	17.6213	18.0307	18.6308	19.4100	20.0902	20.5974	20.8272	20.7879	20.3999	19.5033	18.4379	17.5617	(87)
Th 2	19.5890	19.5923	19.5955	19.6105	19.6134	19.6266	19.6266	19.6290	19.6215	19.6134	19.6077	19.6017	(88)
util rest of house	0.9326	0.9020	0.8575	0.7758	0.6572	0.4952	0.3420	0.3817	0.5982	0.8052	0.9035	0.9391	(89)
MIT 2	15.7666	16.2780	17.0246	17.9815	18.7808	19.3367	19.5438	19.5194	19.1492	18.1212	16.8046	15.6964	(90)
Living area fraction									fLA = Living area / (4) =			0.4778	(91)
MIT	16.6527	17.1154	17.7920	18.6640	19.4064	19.9390	20.1570	20.1254	19.7468	18.7815	17.5849	16.5876	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.6527	17.1154	17.7920	18.6640	19.4064	19.9390	20.1570	20.1254	19.7468	18.7815	17.5849	16.5876	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9035	0.8688	0.8232	0.7481	0.6479	0.5168	0.3916	0.4283	0.6063	0.7783	0.8721	0.9115	(94)
Useful gains	684.5384	789.5152	845.9644	863.6075	796.0269	627.0311	455.8438	466.1319	610.1067	679.4063	665.2911	654.6957	(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	1815.7726	1790.6672	1650.8461	1409.3611	1109.6873	760.1768	506.4460	529.3172	807.5032	1178.1016	1517.1415	1801.5383	(97)
Space heating kWh	841.6382	672.7741	598.8320	392.9426	233.3633	0.0000	0.0000	0.0000	0.0000	371.0293	613.3323	853.2508	(98a)
Space heating requirement - total per year (kWh/year)												4577.1627	
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	841.6382	672.7741	598.8320	392.9426	233.3633	0.0000	0.0000	0.0000	0.0000	371.0293	613.3323	853.2508	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4577.1627	
Space heating per m2											(98c) / (4) =	50.8574	(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	841.6382	672.7741	598.8320	392.9426	233.3633	0.0000	0.0000	0.0000	0.0000	371.0293	613.3323	853.2508	(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)	911.8508	728.8994	648.7887	425.7233	252.8313	0.0000	0.0000	0.0000	0.0000	401.9819	664.4987	924.4321	(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	238.5584	210.9202	224.2145	197.7720	192.0762	173.4950	171.6637	178.3343	180.1004	200.2954	212.2753	236.0649	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6420	86.4723	86.1530	85.5690	84.4975	79.8000	79.8000	79.8000	79.8000	85.4225	86.2976	86.6814	(217)
Fuel for water heating, kWh/month	275.3382	243.9166	260.2514	231.1259	227.3158	217.4122	215.1175	223.4765	225.6897	234.4762	245.9807	272.3362	(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	25.1242	20.1556	18.1479	13.2959	10.2701	8.3908	9.3688	12.1779	15.8179	20.7539	23.4415	25.8225	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-68.3070	-89.2247	-118.9509	-123.7547	-125.6127	-114.5446	-113.0491	-110.3378	-104.7496	-96.8919	-72.4954	-59.9173	(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	-63.4707	-129.5694	-250.6243	-366.9280	-476.4284	-475.6154	-470.0508	-401.9224	-299.9430	-181.9890	-83.5967	-50.5019	(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	4959.0062	(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	2872.4370	(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)	202.7669	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-4448.4755	(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	3671.7346	(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	4959.0062	0.2100	1041.3913	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2872.4370	0.2100	603.2118	(264)
Space and water heating			1644.6031	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	202.7669	0.1443	29.2655	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1197.8356	0.1363	-163.2090	
PV Unit electricity exported	-3250.6399	0.1267	-411.7406	
Total			-574.9495	(269)
Total CO2, kg/year			1110.8483	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.3400	(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	4959.0062	1.1300	5603.6770	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2872.4370	1.1300	3245.8538	(278)
Space and water heating			8849.5308	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	202.7669	1.5338	311.0106	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1197.8356	1.5037	-1801.1364	
PV Unit electricity exported	-3250.6399	0.4650	-1511.4805	
Total			-3312.6169	(283)
Total Primary energy kWh/year			5978.0253	(286)
Target Primary Energy Rate (TPER)			66.4200	(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		90.0000	(1b) x	3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	335.7000	(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) =	0.0894	(8)
Pressure test												Yes	
Pressure Test Method												Blower Door	
Measured/design AP50												4.0000	(17)
Infiltration rate												0.2894	(18)
Number of sides sheltered												0	(19)
Shelter factor										(20) = 1 - [0.075 x (19)] =		1.0000	(20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =		0.2894	(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													
	0.3689	0.3617	0.3545	0.3183	0.3111	0.2749	0.2749	0.2677	0.2894	0.3111	0.3255	0.3400	(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	0.5681	0.5654	0.5628	0.5507	0.5484	0.5378	0.5378	0.5358	0.5419	0.5484	0.5530	0.5578	(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								
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200
E3 Sill	11.8000	0.0220	0.2596
E4 Jamb	33.6000	0.0170	0.5712
E5 Ground floor (normal)	45.0000	0.0700	3.1500
E16 Corner (normal)	21.6000	0.0420	0.9072
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	3.9200	0.2400	0.9408
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0850	-1.8360
E11 Eaves (insulation at rafter level)	45.0000	0.0180	0.8100

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.8908	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	74.4122	(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	62.9301	62.6373	62.3504	61.0025	60.7503	59.5763	59.5763	59.3589	60.0285	60.7503	61.2604	61.7938	(38)
Heat transfer coeff	137.3423	137.0495	136.7626	135.4147	135.1625	133.9885	133.9885	133.7711	134.4407	135.1625	135.6726	136.2060	(39)
Average = Sum(39)m / 12 =												135.4134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5260	1.5228	1.5196	1.5046	1.5018	1.4888	1.4888	1.4863	1.4938	1.5018	1.5075	1.5134	(40)
HLP (average)												1.5046	
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	2.6257	(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

29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)

Hot water usage for other uses

41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)

Average daily hot water use (litres/day)	65.0693	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	70.9906	69.0431	66.9169	64.2707	61.9099	59.4565	58.9469	61.0687	63.2449	65.7644	68.4340	70.8909	(44)
Energy conte	112.4317	98.3164	102.8488	87.9833	83.3426	73.1087	71.2911	75.6158	77.9873	89.2417	97.4968	110.9981	(45)
Energy content (annual)										Total = Sum(45)m =		1080.6625	
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 (or HIU 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	95.5670	83.5690	87.4215	74.7858	70.8412	62.1424	60.5975	64.2735	66.2892	75.8554	82.8723	94.3484	(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	95.5670	83.5690	87.4215	74.7858	70.8412	62.1424	60.5975	64.2735	66.2892	75.8554	82.8723	94.3484	(64)
									Total per year (kWh/year) = Sum(64)m =			918.5631	(64)
12Total per year (kWh/year)												919	(64)

Electric shower(s)

54.6524	48.6958	53.1739	50.7432	51.6954	49.3124	50.9561	51.6954	50.7432	53.1739	52.1740	54.6524	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	621.6683	(64a)

Heat gains from water heating, kWh/month

37.5548	33.0662	35.1489	31.3823	30.6342	27.8637	27.8884	28.9922	29.2581	32.2573	33.7616	37.2502	(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	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.9173	133.8727	120.9173	124.9479	120.9173	124.9479	120.9173	120.9173	124.9479	120.9173	124.9479	120.9173	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(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)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	50.4769	49.2056	47.2431	43.5865	41.1749	38.6996	37.4844	38.9680	40.6363	43.3566	46.8911	50.0675	(72)
Total internal gains													
	472.8578	487.0228	465.8531	452.9178	429.6753	415.4404	399.6459	398.6486	410.5992	422.5982	446.9637	461.8996	(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	
Northeast	1.4700	11.2829	0.7200	0.7000	0.7700	5.7930	(75)
East	3.0000	19.6403	0.7200	0.7000	0.7700	20.5794	(76)
Southeast	2.8800	36.7938	0.7200	0.7000	0.7700	37.0110	(77)
South	2.3100	46.7521	0.7200	0.7000	0.7700	37.7204	(78)
Southwest	6.5100	36.7938	0.7200	0.7000	0.7700	83.6604	(79)
Northwest	0.8400	11.2829	0.7200	0.7000	0.7700	3.3103	(81)
Northwest	1.5700	26.0000	0.7200	0.7000	1.0000	18.5160	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	206.5905	364.5682	527.9823	695.7523	811.9284	818.9928	784.3175	696.6040	586.4123	411.2222	249.8635	175.1764	(83)
Total gains	679.4482	851.5910	993.8353	1148.6701	1241.6037	1234.4332	1183.9634	1095.2526	997.0114	833.8204	696.8272	637.0760	(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	18.2027	18.2416	18.2799	18.4618	18.4963	18.6583	18.6583	18.6886	18.5956	18.4963	18.4267	18.3545	
alpha	2.2135	2.2161	2.2187	2.2308	2.2331	2.2439	2.2439	2.2459	2.2397	2.2331	2.2284	2.2236	
util living area													
	0.9514	0.9219	0.8792	0.8017	0.6949	0.5596	0.4396	0.4821	0.6661	0.8445	0.9286	0.9573	(86)
MIT	17.6980	18.1477	18.7719	19.5519	20.2039	20.6619	20.8599	20.8229	20.4664	19.5832	18.5025	17.6224	(87)
Th 2	19.6680	19.6705	19.6728	19.6840	19.6861	19.6959	19.6959	19.6978	19.6922	19.6861	19.6819	19.6775	(88)
util rest of house													
	0.9434	0.9094	0.8595	0.7685	0.6412	0.4764	0.3280	0.3699	0.5896	0.8106	0.9149	0.9502	(89)
MIT 2	16.7218	17.1624	17.7700	18.5185	19.1138	19.5040	19.6422	19.6246	19.3602	18.5709	17.5257	16.6532	(90)
Living area fraction									fLA = Living area / (4) =			0.4778	(91)
MIT	17.1882	17.6332	18.2487	19.0122	19.6347	20.0572	20.2240	20.1971	19.8887	19.0546	17.9924	17.1163	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.1882	17.6332	18.2487	19.0122	19.6347	20.0572	20.2240	20.1971	19.8887	19.0546	17.9924	17.1163	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9224	0.8840	0.8330	0.7486	0.6388	0.5011	0.3755	0.4155	0.6024	0.7907	0.8915	0.9307	(94)
Useful gains	626.7407	752.8430	827.9075	859.9319	793.1524	618.5485	444.5280	455.0800	600.5564	659.3205	621.1919	592.9455	(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													
	1770.0961	1745.0784	1606.7803	1369.3452	1072.4692	731.2003	485.5708	507.9406	778.2367	1142.7426	1477.8000	1759.2742	(97)
Space heating kWh													
	850.6564	666.7822	579.4814	366.7776	207.8117	0.0000	0.0000	0.0000	0.0000	359.6661	616.7579	867.7485	(98a)
Space heating requirement - total per year (kWh/year)												4515.6818	
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													
	850.6564	666.7822	579.4814	366.7776	207.8117	0.0000	0.0000	0.0000	0.0000	359.6661	616.7579	867.7485	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4515.6818	
Space heating per m2											(98c) / (4) =	50.1742	(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	1259.4917	991.5147	1016.6601	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7205	0.7825	0.7518	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	907.5085	775.9016	764.3327	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1371.0886	1315.7741	1218.3078	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	333.7777	401.6652	337.7575	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	83.4444	100.4163	84.4394	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												268.3001	(107)

Energy for space heating		50.1742 (99)
Energy for space cooling		2.9811 (108)
Total		53.1554 (109)
Fabric Energy Efficiency (DFEE)		53.2 (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	90.0000	(1b)	x 3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.7000	(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) =	0.0894 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.3394 (18)
Number of sides sheltered		0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3394 (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	0.4327	0.4242	0.4157	0.3733	0.3648	0.3224	0.3224	0.3139	0.3394	0.3648	0.3818	0.3988	(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	0.5936	0.5900	0.5864	0.5697	0.5665	0.5520	0.5520	0.5493	0.5576	0.5665	0.5729	0.5795	(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			2.1000	1.0000	2.1000			(26a)
TER Opening Type			17.0100	1.1450	19.4771			(27)
TER Roof Light			1.5700	1.5918	3.1746			(27a)
Heatloss Floor 1			90.0000	0.1300	11.7000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1800	16.0002			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1100	14.6773			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.7852			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	12.8000	0.0500	0.6400
E3	Sill	11.8000	0.0500	0.5900
E4	Jamb	33.6000	0.0500	1.6800
E5	Ground floor (normal)	45.0000	0.1600	7.2000
E16	Corner (normal)	21.6000	0.0900	1.9440
R1	Head of roof window	1.6000	0.0800	0.1280
R2	Sill of roof window	1.6000	0.0600	0.0960
R3	Jamb of roof window	3.9200	0.0800	0.3136
E17	Corner (inverted - internal area greater than external area)	21.6000	-0.0900	-1.9440
E11	Eaves (insulation at rafter level)	45.0000	0.0400	1.8000

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.4476	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 81.2328	(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	65.7608	65.3581	64.9634	63.1094	62.7625	61.1478	61.1478	60.8488	61.7698	62.7625	63.4643	64.1979	(38)
Heat transfer coeff	146.9936	146.5909	146.1962	144.3422	143.9954	142.3806	142.3806	142.0816	143.0026	143.9954	144.6971	145.4307	(39)
Average = Sum(39)m / 12 =												144.3406	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.6333	1.6288	1.6244	1.6038	1.5999	1.5820	1.5820	1.5787	1.5889	1.5999	1.6077	1.6159	(40)
HLP (average)												1.6038	

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												2.6257	(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													
	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses													
	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												65.0693	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	70.9906	69.0431	66.9169	64.2707	61.9099	59.4565	58.9469	61.0687	63.2449	65.7644	68.4340	70.8909	(44)
Energy conte	112.4317	98.3164	102.8488	87.9833	83.3426	73.1087	71.2911	75.6158	77.9873	89.2417	97.4968	110.9981	(45)
Energy content (annual)											Total = Sum(45)m =	1080.6625	
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 (or HIU 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													
	95.5670	83.5690	87.4215	74.7858	70.8412	62.1424	60.5975	64.2735	66.2892	75.8554	82.8723	94.3484	(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													
	95.5670	83.5690	87.4215	74.7858	70.8412	62.1424	60.5975	64.2735	66.2892	75.8554	82.8723	94.3484	(64)
										Total per year (kWh/year) = Sum(64)m =		918.5631	(64)
12Total per year (kWh/year)												919	(64)
Electric shower(s)													
	54.6524	48.6958	53.1739	50.7432	51.6954	49.3124	50.9561	51.6954	50.7432	53.1739	52.1740	54.6524	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		621.6683	(64a)
Heat gains from water heating, kWh/month													
	37.5548	33.0662	35.1489	31.3823	30.6342	27.8637	27.8884	28.9922	29.2581	32.2573	33.7616	37.2502	(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	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	131.2860	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	120.9173	133.8727	120.9173	124.9479	120.9173	124.9479	120.9173	120.9173	124.9479	120.9173	124.9479	120.9173	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	239.0777	241.5586	235.3069	221.9977	205.1972	189.4071	178.8584	176.3775	182.6292	195.9384	212.7389	228.5290	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	36.1286	(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)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	50.4769	49.2056	47.2431	43.5865	41.1749	38.6996	37.4844	38.9680	40.6363	43.3566	46.8911	50.0675	(72)
Total internal gains													
	472.8578	487.0228	465.8531	452.9178	429.6753	415.4404	399.6459	398.6486	410.5992	422.5982	446.9637	461.8996	(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	
Northeast	1.4700	11.2829	0.6300	0.7000	0.7700	5.0689	(75)
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(76)
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)
South	2.3100	46.7521	0.6300	0.7000	0.7700	33.0054	(78)
Southwest	6.5100	36.7938	0.6300	0.7000	0.7700	73.2028	(79)
Northwest	0.8400	11.2829	0.6300	0.7000	0.7700	2.8965	(81)
Northwest	1.5700	26.0000	0.6300	0.7000	1.0000	16.2015	(82)

Solar gains	180.7666	318.9972	461.9845	608.7832	710.4374	716.6187	686.2778	609.5285	513.1107	359.8194	218.6305	153.2793	(83)
Total gains	653.6244	806.0200	927.8375	1061.7011	1140.1126	1132.0591	1085.9237	1008.1771	923.7099	782.4176	665.5942	615.1789	(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	17.0075	17.0543	17.1003	17.3199	17.3617	17.5586	17.5586	17.5955	17.4822	17.3617	17.2775	17.1903	
alpha	2.1338	2.1370	2.1400	2.1547	2.1574	2.1706	2.1706	2.1730	2.1655	2.1574	2.1518	2.1460	
util living area													
	0.9557	0.9313	0.8963	0.8306	0.7363	0.6078	0.4873	0.5293	0.7064	0.8649	0.9361	0.9607	(86)
MIT	17.4481	17.8722	18.4932	19.3070	20.0205	20.5603	20.8082	20.7634	20.3426	19.3910	18.2851	17.3865	(87)
Th 2	19.5890	19.5923	19.5955	19.6105	19.6134	19.6266	19.6266	19.6290	19.6215	19.6134	19.6077	19.6017	(88)
util rest of house													
	0.9481	0.9197	0.8781	0.7993	0.6831	0.5201	0.3628	0.4062	0.6290	0.8329	0.9233	0.9539	(89)
MIT 2	16.4299	16.8473	17.4554	18.2451	18.9064	19.3764	19.5538	19.5319	19.2113	18.3467	17.2701	16.3768	(90)
Living area fraction										fLA = Living area / (4) =		0.4778	(91)
MIT	16.9164	17.3370	17.9512	18.7524	19.4387	19.9420	20.1531	20.1203	19.7518	18.8457	17.7550	16.8592	(92)
Temperature adjustment												0.0000	

adjusted MIT	16.9164	17.3370	17.9512	18.7524	19.4387	19.9420	20.1531	20.1203	19.7518	18.8457	17.7550	16.8592	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9273	0.8943	0.8505	0.7758	0.6754	0.5421	0.4138	0.4539	0.6374	0.8106	0.8997	0.9346	(94)
Useful gains	606.0868	720.8422	789.1288	823.7066	770.0796	613.6937	449.3979	457.6233	588.7525	634.1961	598.8090	574.9283	(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	1854.5286	1823.1530	1674.1256	1422.1221	1114.3361	760.5978	505.8926	528.5814	808.2289	1187.3360	1541.7546	1841.0390	(97)
Space heating kWh	928.8407	740.7528	658.4376	430.8592	256.1269	0.0000	0.0000	0.0000	0.0000	411.5361	678.9209	941.9863	(98a)
Space heating requirement - total per year (kWh/year)												5047.4604	
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	928.8407	740.7528	658.4376	430.8592	256.1269	0.0000	0.0000	0.0000	0.0000	411.5361	678.9209	941.9863	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5047.4604	
Space heating per m2											(98c) / (4) =	56.0829	(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	1338.3778	1053.6166	1079.8201	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6622	0.7289	0.6969	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	886.2269	768.0296	752.5567	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1254.4364	1204.0228	1118.8908	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	265.1108	324.3789	272.5526	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	66.2777	81.0947	68.1382	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												215.5106	(107)
Energy for space heating												56.0829	(99)
Energy for space cooling												2.3946	(108)
Total												58.4775	(109)
Fabric Energy Efficiency (TFEE)												58.5	(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	90.0000	(1b)	x 3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.7000	(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) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3192	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3192	(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	0.4069	0.3989	0.3910	0.3511	0.3431	0.3032	0.3032	0.2952	0.3192	0.3431	0.3590	0.3750	(22b)
Effective ac	0.5828	0.5796	0.5764	0.5616	0.5589	0.5460	0.5460	0.5436	0.5509	0.5589	0.5645	0.5703	(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								
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element				
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200	
E3 Sill	11.8000	0.0220	0.2596	
E4 Jamb	33.6000	0.0170	0.5712	
E5 Ground floor (normal)	45.0000	0.0700	3.1500	
E16 Corner (normal)	21.6000	0.0420	0.9072	
R1 Head of roof window	1.6000	0.2400	0.3840	
R2 Sill of roof window	1.6000	0.2400	0.3840	
R3 Jamb of roof window	3.9200	0.2400	0.9408	
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0850	-1.8360	
E11 Eaves (insulation at rafter level)	45.0000	0.0180	0.8100	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8908 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 74.4122 (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	64.5623	64.2062	63.8571	62.2174	61.9106	60.4824	60.4824	60.2180	61.0325	61.9106	62.5312	63.1800	(38)
Heat transfer coeff	138.9745	138.6184	138.2693	136.6296	136.3228	134.8946	134.8946	134.6302	135.4447	136.3228	136.9434	137.5922	(39)
Average = Sum(39)m / 12 =												136.6281	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5442	1.5402	1.5363	1.5181	1.5147	1.4988	1.4988	1.4959	1.5049	1.5147	1.5216	1.5288	(40)
HLP (average)												1.5181	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6257 (42)

Hot water usage for mixer showers

	85.3056	84.0236	82.1555	78.5812	75.9435	73.0020	71.3300	73.1840	75.2162	78.3746	82.0256	84.9787	(42a)
Hot water usage for baths													
	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses													
	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												143.7182	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.2961	153.0667	149.0724	142.8519	137.8534	132.4585	130.2769	134.2527	138.4612	144.1390	150.4596	155.8697	(44)
Energy conte	247.5349	217.9649	229.1188	195.5571	185.5772	162.8732	157.5586	166.2329	170.7365	195.5952	214.3573	244.0542	(45)
Energy content (annual)										Total = Sum(45)m =		2387.1608	
Distribution loss (46)m = 0.15 x (45)m													
	37.1302	32.6947	34.3678	29.3336	27.8366	24.4310	23.6338	24.9349	25.6105	29.3393	32.1536	36.6081	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6588	(55)
Total storage loss													
	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage													
	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
										Total per year (kWh/year) = Sum(64)m =		2901.5188	(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													
	117.2535	104.0394	111.1301	98.8435	96.6526	87.9761	87.3364	90.2206	90.5907	99.9836	105.0946	116.0962	(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	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.2397	28.6350	23.2876	17.6302	13.1788	11.1261	12.0221	15.6268	20.9742	26.6316	31.0830	33.1357	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	356.8324	360.5352	351.2043	331.3398	306.2645	282.6972	266.9528	263.2500	272.5809	292.4454	317.5208	341.0881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	(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)	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													

	157.5988	154.8206	149.3685	137.2827	129.9094	122.1891	117.3876	121.2642	125.8204	134.3865	145.9647	156.0433	(72)
Total internal gains	652.5654	649.8853	629.7548	592.1472	555.2471	521.9068	502.2570	506.0355	525.2700	559.3580	600.4630	636.1615	(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	
Northeast	1.4700	11.2829	0.7200	0.7000	0.7700	5.7930	(75)
East	3.0000	19.6403	0.7200	0.7000	0.7700	20.5794	(76)
Southeast	2.8800	36.7938	0.7200	0.7000	0.7700	37.0110	(77)
South	2.3100	46.7521	0.7200	0.7000	0.7700	37.7204	(78)
Southwest	6.5100	36.7938	0.7200	0.7000	0.7700	83.6604	(79)
Northwest	0.8400	11.2829	0.7200	0.7000	0.7700	3.3103	(81)
Northwest	1.5700	26.0000	0.7200	0.7000	1.0000	18.5160	(82)

Solar gains	206.5905	364.5682	527.9823	695.7523	811.9284	818.9928	784.3175	696.6040	586.4123	411.2222	249.8635	175.1764	(83)
Total gains	859.1558	1014.4535	1157.7370	1287.8994	1367.1755	1340.8996	1286.5745	1202.6395	1111.6823	970.5802	850.3265	811.3379	(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	17.9889	18.0351	18.0807	18.2977	18.3388	18.5330	18.5330	18.5694	18.4577	18.3388	18.2557	18.1696	
alpha	2.1993	2.2023	2.2054	2.2198	2.2226	2.2355	2.2355	2.2380	2.2305	2.2226	2.2170	2.2113	
util living area	0.9261	0.8956	0.8480	0.7702	0.6633	0.5310	0.4133	0.4509	0.6288	0.8073	0.8998	0.9336	(86)
Living	19.8243	19.9247	20.0744	20.2560	20.4071	20.5145	20.5598	20.5525	20.4712	20.2697	20.0164	19.8085	
Non living	18.5671	18.6670	18.8138	18.9976	19.1362	19.2366	19.2676	19.2662	19.2013	19.0180	18.7714	18.5621	
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	20.3986	19.9247	20.0744	20.2560	20.4071	20.5145	20.5598	20.5525	20.4712	20.2697	20.0164	19.9751	(87)
Th 2	19.6545	19.6575	19.6604	19.6739	19.6765	19.6884	19.6884	19.6906	19.6838	19.6765	19.6713	19.6660	(88)
util rest of house	0.9146	0.8797	0.8247	0.7341	0.6079	0.4487	0.3057	0.3425	0.5509	0.7684	0.8818	0.9232	(89)
MIT 2	19.0982	18.6670	18.8138	18.9976	19.1362	19.2366	19.2676	19.2662	19.2013	19.0180	18.7714	18.7165	(90)
Living area fraction										fLA = Living area / (4) =		0.4778	(91)
MIT	19.7195	19.2679	19.4161	19.5988	19.7434	19.8471	19.8850	19.8808	19.8081	19.6160	19.3662	19.3178	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7195	19.2679	19.4161	19.5988	19.7434	19.8471	19.8850	19.8808	19.8081	19.6160	19.3662	19.3178	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9152	0.8745	0.8199	0.7318	0.6109	0.4595	0.3229	0.3594	0.5590	0.7664	0.8771	0.9201	(94)
Useful gains	786.2824	887.1174	949.2103	942.5256	835.2283	616.0980	415.4335	432.1909	621.4834	743.8860	745.8166	746.4765	(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	2142.9176	1991.6565	1785.8975	1461.7729	1096.5047	707.8097	443.1238	468.6145	773.1268	1229.0909	1679.7758	2080.0975	(97)
Space heating kWh	1009.3366	742.2503	622.4953	373.8581	194.3896	0.0000	0.0000	0.0000	0.0000	360.9925	672.4507	992.2140	(98a)
Space heating requirement - total per year (kWh/year)												4967.9870	
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	1009.3366	742.2503	622.4953	373.8581	194.3896	0.0000	0.0000	0.0000	0.0000	360.9925	672.4507	992.2140	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4967.9870	
Space heating per m2											(98c) / (4) =	55.1999	(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 %)	310.3961	(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	1009.3366	742.2503	622.4953	373.8581	194.3896	0.0000	0.0000	0.0000	0.0000	360.9925	672.4507	992.2140	(98)
Space heating efficiency (main heating system 1)	310.3961	310.3961	310.3961	310.3961	310.3961	0.0000	0.0000	0.0000	0.0000	310.3961	310.3961	310.3961	(210)
Space heating fuel (main heating system)	325.1769	239.1300	200.5487	120.4455	62.6263	0.0000	0.0000	0.0000	0.0000	116.3006	216.6427	319.6606	(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	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
Efficiency of water heater												271.6210	(216)
(217)m	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	(217)
Fuel for water heating, kWh/month	107.2156	94.7727	100.4355	87.5607	84.4053	75.5277	74.0899	77.2834	78.4227	88.0935	94.4821	105.9342	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)

Lighting	28.2192	22.6385	20.3835	14.9338	11.5353	9.4244	10.5229	13.6780	17.7664	23.3105	26.3292	29.0035	(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	1600.5313	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	271.6210	
Water heating fuel used	1068.2233	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(231)
Electricity for lighting (calculated in Appendix L)	227.7452	(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	2896.4997	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1600.5313	16.4900	263.9276	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1068.2233	16.4900	176.1500	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	227.7452	16.4900	37.5552	(250)
Additional standing charges			0.0000	(251)
Total energy cost			477.6328	(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] =	1.2737	(257)
SAP value		79.3535	
SAP rating (Section 12)		79	(258)
SAP band		C	

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	1600.5313	0.1550	248.0736	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1068.2233	0.1411	150.6945	(264)
Space and water heating			398.7680	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	227.7452	0.1443	32.8707	(268)
Total CO2, kg/year			431.6387	(272)
CO2 emissions per m2			4.8000	(273)
EI value			95.7156	
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		90.0000	(1b)	x 3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		335.7000	(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) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3192	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3192	(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	0.3670	0.3351	0.3271	0.3192	0.3351	0.2952	0.3112	0.2952	0.2952	0.3192	0.3112	0.3271	(22b)
Effective ac	0.5674	0.5561	0.5535	0.5509	0.5561	0.5436	0.5484	0.5436	0.5436	0.5509	0.5484	0.5535	(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								
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200
E3 Sill	11.8000	0.0220	0.2596
E4 Jamb	33.6000	0.0170	0.5712
E5 Ground floor (normal)	45.0000	0.0700	3.1500
E16 Corner (normal)	21.6000	0.0420	0.9072
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	3.9200	0.2400	0.9408
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0850	-1.8360
E11 Eaves (insulation at rafter level)	45.0000	0.0180	0.8100

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.8908 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	74.4122 (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	62.8521	61.6108	61.3182	61.0325	61.6108	60.2180	60.7540	60.2180	60.2180	61.0325	60.7540	61.3182	(38)
Heat transfer coeff	137.2643	136.0230	135.7304	135.4447	136.0230	134.6302	135.1662	134.6302	134.6302	135.4447	135.1662	135.7304	(39)
Average = Sum(39)m / 12 =												135.4903	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5252	1.5114	1.5081	1.5049	1.5114	1.4959	1.5018	1.4959	1.4959	1.5049	1.5018	1.5081	(40)
HLP (average)												1.5054	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy											2.6257	(42)
Hot water usage for mixer showers	85.3056	84.0236	82.1555	78.5812	75.9435	73.0020	71.3300	73.1840	75.2162	78.3746	82.0256	84.9787	(42a)
Hot water usage for baths	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												143.7182	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.2961	153.0667	149.0724	142.8519	137.8534	132.4585	130.2769	134.2527	138.4612	144.1390	150.4596	155.8697	(44)
Energy conte	247.5349	217.9649	229.1188	195.5571	185.5772	162.8732	157.5586	166.2329	170.7365	195.5952	214.3573	244.0542	(45)
Energy content (annual)										Total = Sum(45)m =		2387.1608	
Distribution loss (46)m = 0.15 x (45)m	37.1302	32.6947	34.3678	29.3336	27.8366	24.4310	23.6338	24.9349	25.6105	29.3393	32.1536	36.6081	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6588	(55)
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
										Total per year (kWh/year) = Sum(64)m =		2901.5188	(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													
	117.2535	104.0394	111.1301	98.8435	96.6526	87.9761	87.3364	90.2206	90.5907	99.9836	105.0946	116.0962	(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	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.2397	28.6350	23.2876	17.6302	13.1788	11.1261	12.0221	15.6268	20.9742	26.6316	31.0830	33.1357	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	356.8324	360.5352	351.2043	331.3398	306.2645	282.6972	266.9528	263.2500	272.5809	292.4454	317.5208	341.0881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	(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)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	157.5988	154.8206	149.3685	137.2827	129.9094	122.1891	117.3876	121.2642	125.8204	134.3865	145.9647	156.0433	(72)
Total internal gains													
	652.5654	649.8853	629.7548	592.1472	555.2471	521.9068	502.2570	506.0355	525.2700	559.3580	600.4630	636.1615	(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	
Northeast	1.4700	15.4726	0.7200	0.7000	0.7700	7.9441	(75)
East	3.0000	26.6540	0.7200	0.7000	0.7700	27.9285	(76)
Southeast	2.8800	47.7150	0.7200	0.7000	0.7700	47.9967	(77)
South	2.3100	59.9148	0.7200	0.7000	0.7700	48.3404	(78)
Southwest	6.5100	47.7150	0.7200	0.7000	0.7700	108.4925	(79)
Northwest	0.8400	15.4726	0.7200	0.7000	0.7700	4.5395	(81)
Northwest	1.5700	36.0000	0.7200	0.7000	1.0000	25.6375	(82)

Solar gains	270.8792	404.0453	579.5888	787.4570	890.9053	963.1340	925.3297	821.4786	692.1331	486.6209	315.6928	228.9767	(83)
Total gains	923.4446	1053.9305	1209.3436	1379.6041	1446.1524	1485.0408	1427.5867	1327.5141	1217.4032	1045.9789	916.1558	865.1382	(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	18.2130	18.3792	18.4189	18.4577	18.3792	18.5694	18.4958	18.5694	18.5694	18.4577	18.4958	18.4189	
alpha	2.2142	2.2253	2.2279	2.2305	2.2253	2.2380	2.2331	2.2380	2.2380	2.2305	2.2331	2.2279	
util living area													
	0.9063	0.8778	0.8195	0.7196	0.5877	0.4207	0.2961	0.3149	0.5234	0.7414	0.8646	0.9138	(86)
Living	19.9264	20.0072	20.1588	20.3325	20.4692	20.5533	20.5787	20.5781	20.5255	20.3664	20.1374	19.9278	
Non living	18.6798	18.7667	18.9136	19.0762	19.1903	19.2647	19.2740	19.2790	19.2482	19.1123	18.9016	18.6933	
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	20.4508	20.0072	20.1588	20.3325	20.4692	20.5533	20.5787	20.5781	20.5255	20.3664	20.1374	20.0778	(87)
Th 2	19.6687	19.6790	19.6814	19.6838	19.6790	19.6906	19.6861	19.6906	19.6906	19.6838	19.6861	19.6814	(88)
util rest of house													
	0.8914	0.8591	0.7918	0.6764	0.5213	0.3298	0.1844	0.1974	0.4307	0.6887	0.8395	0.8997	(89)
MIT 2	19.1628	18.7667	18.9136	19.0762	19.1903	19.2647	19.2740	19.2790	19.2482	19.1123	18.9016	18.8315	(90)
Living area fraction											fLA = Living area / (4) =	0.4778	(91)
MIT	19.7782	19.3594	19.5085	19.6764	19.8013	19.8804	19.8974	19.8997	19.8585	19.7115	19.4920	19.4270	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7782	19.3594	19.5085	19.6764	19.8013	19.8804	19.8974	19.8997	19.8585	19.7115	19.4920	19.4270	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8540	0.7878	0.6762	0.5280	0.3437	0.2031	0.2170	0.4435	0.6900	0.8353	0.8966	(94)
Useful gains	824.4389	900.0548	952.7008	932.8566	763.5361	510.4032	289.9038	288.0660	539.9761	721.6788	765.2217	775.7251	(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													
	1987.3364	1857.9902	1643.4937	1324.1617	925.1389	549.3420	297.0098	296.1410	613.7087	1044.4766	1485.7484	1890.3128	(97)
Space heating kWh													
	865.1957	643.7326	513.9500	281.7397	120.2325	0.0000	0.0000	0.0000	0.0000	240.1616	518.7792	829.2533	(98a)
Space heating requirement - total per year (kWh/year)												4013.0446	
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													
	865.1957	643.7326	513.9500	281.7397	120.2325	0.0000	0.0000	0.0000	0.0000	240.1616	518.7792	829.2533	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4013.0446	
Space heating per m2											(98c) / (4) =	44.5894	(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 %)												309.0847	(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													
	865.1957	643.7326	513.9500	281.7397	120.2325	0.0000	0.0000	0.0000	0.0000	240.1616	518.7792	829.2533	(98)
Space heating efficiency (main heating system 1)													
	309.0847	309.0847	309.0847	309.0847	309.0847	0.0000	0.0000	0.0000	0.0000	309.0847	309.0847	309.0847	(210)
Space heating fuel (main heating system)													
	279.9219	208.2706	166.2813	91.1529	38.8995	0.0000	0.0000	0.0000	0.0000	77.7009	167.8437	268.2932	(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													
	291.2201	257.4225	272.8040	237.8331	229.2624	205.1492	201.2438	209.9181	213.0125	239.2804	256.6333	287.7394	(64)
Efficiency of water heater												271.4953	(216)
(217)m	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	(217)
Fuel for water heating, kWh/month													
	107.2653	94.8166	100.4820	87.6012	84.4444	75.5627	74.1242	77.3192	78.4590	88.1343	94.5259	105.9832	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	28.2192	22.6385	20.3835	14.9338	11.5353	9.4244	10.5229	13.6780	17.7664	23.3105	26.3292	29.0035	(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												1298.3639	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												271.4953	
Water heating fuel used												1068.7180	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												227.7452	(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												2594.8271	(238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1298.3639	28.4300	369.1249	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1068.7180	28.4300	303.8365	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	227.7452	28.4300	64.7480	(250)
Additional standing charges			0.0000	(251)
Total energy cost			737.7093	(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	1298.3639	0.1557	202.2047	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1068.7180	0.1411	150.7643	(264)
Space and water heating			352.9690	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	227.7452	0.1443	32.8707	(268)
Total CO2, kg/year			385.8396	(272)

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

	Energy	Primary energy factor	Primary energy	

	kWh/year	kg CO2/kWh	kWh/year	
Space heating - main system 1	1298.3639	1.5766	2046.9513	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1068.7180	1.5216	1626.1988	(278)
Space and water heating			3673.1501	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	227.7452	1.5338	349.3232	(282)
Total Primary energy kWh/year			4022.4733	(286)

SAP 10 EPC IMPROVEMENTS

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without PV

Current energy efficiency rating: C 79
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	+ 1.2	-£ 67	-29 kg (7.6%)
U Solar photovoltaic panels	+ 8.2	-£ 331	-261 kg (73.1%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£67	0.32 kg/m²	B 81	A 96
Solar photovoltaic panels	£331	2.90 kg/m²	B 89	A 98
Total Savings	£398	3.22 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 590 TEST (30 Jan 2026)
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	£738	£671	£67
Space heating	£369	£392	-£23
Water heating	£304	£214	£90
Lighting	£65	£65	£0
Generated (PV)	-£0	-£331	£331
Total cost of fuels	£738	£340	£398
Total cost of uses	£738	£340	£398
Delivered energy	29 kWh/m²	4 kWh/m²	25 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	45 kWh/m²	20 kWh/m²	25 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	90.0000	(1b)	x 3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	335.7000	(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) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3192	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)

Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.3192 (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	0.4069	0.3989	0.3910	0.3511	0.3431	0.3032	0.3032	0.2952	0.3192	0.3431	0.3590	0.3750	(22b)
Effective ac	0.5828	0.5796	0.5764	0.5616	0.5589	0.5460	0.5460	0.5436	0.5509	0.5589	0.5645	0.5703	(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	
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200
E3 Sill	11.8000	0.0220	0.2596
E4 Jamb	33.6000	0.0170	0.5712
E5 Ground floor (normal)	45.0000	0.0700	3.1500
E16 Corner (normal)	21.6000	0.0420	0.9072
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	3.9200	0.2400	0.9408
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0850	-1.8360
E11 Eaves (insulation at rafter level)	45.0000	0.0180	0.8100

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.8908 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 74.4122 (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	64.5623	64.2062	63.8571	62.2174	61.9106	60.4824	60.4824	60.2180	61.0325	61.9106	62.5312	63.1800	(38)
Heat transfer coeff	138.9745	138.6184	138.2693	136.6296	136.3228	134.8946	134.8946	134.6302	135.4447	136.3228	136.9434	137.5922	(39)
Average = Sum(39)m / 12 =												136.6281	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5442	1.5402	1.5363	1.5181	1.5147	1.4988	1.4988	1.4959	1.5049	1.5147	1.5216	1.5288	(40)
HLP (average)												1.5181	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.6257 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	85.3056	84.0236	82.1555	78.5812	75.9435	73.0020	71.3300	73.1840	75.2162	78.3746	82.0256	84.9787	(42a)
Hot water usage for baths	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709	(42b)
Hot water usage for other uses	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200	(42c)
Average daily hot water use (litres/day)												143.7182	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	156.2961	153.0667	149.0724	142.8519	137.8534	132.4585	130.2769	134.2527	138.4612	144.1390	150.4596	155.8697	(44)
Energy conte	247.5349	217.9649	229.1188	195.5571	185.5772	162.8732	157.5586	166.2329	170.7365	195.5952	214.3573	244.0542	(45)
Energy content (annual)										Total = Sum(45)m =		2387.1608	
Distribution loss (46)m = 0.15 x (45)m	37.1302	32.6947	34.3678	29.3336	27.8366	24.4310	23.6338	24.9349	25.6105	29.3393	32.1536	36.6081	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6588	(55)
Total storage loss	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(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	291.2201	257.4225	271.4082	231.0795	216.4681	192.5425	188.2168	197.8216	207.6096	237.8847	256.6333	287.7394	(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												630.0116	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												630.0116	
Solar input	-0.0000	-16.1936	-58.8342	-81.2078	-106.4763	-98.0819	-97.2817	-84.8848	-58.3139	-28.7373	-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

	291.2201	241.2289	212.5740	149.8717	109.9918	94.4606	90.9351	112.9368	149.2957	209.1473	256.6333	287.7394 (64)
Total per year (kWh/year) = Sum(64)m =												2206.0348 (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

	117.2535	104.0394	110.0136	93.4407	86.4171	77.8908	76.9148	80.5434	86.2684	98.8670	105.0946	116.0962 (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	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	(66)

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

	32.2397	28.6350	23.2876	17.6302	13.1788	11.1261	12.0221	15.6268	20.9742	26.6316	31.0830	33.1357	(67)

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

	356.8324	360.5352	351.2043	331.3398	306.2645	282.6972	266.9528	263.2500	272.5809	292.4454	317.5208	341.0881	(68)

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

	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	(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)

	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)

Water heating gains (Table 5)

	157.5988	154.8206	147.8677	129.7787	116.1521	108.1816	103.3802	108.2573	119.8172	132.8857	145.9647	156.0433	(72)

Total internal gains

	652.5654	649.8853	628.2540	584.6432	541.4898	507.8993	488.2495	493.0285	519.2668	557.8572	600.4630	636.1615	(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	
Northeast	1.4700	11.2829	0.7200	0.7000	0.7700	5.7930	(75)
East	3.0000	19.6403	0.7200	0.7000	0.7700	20.5794	(76)
Southeast	2.8800	36.7938	0.7200	0.7000	0.7700	37.0110	(77)
South	2.3100	46.7521	0.7200	0.7000	0.7700	37.7204	(78)
Southwest	6.5100	36.7938	0.7200	0.7000	0.7700	83.6604	(79)
Northwest	0.8400	11.2829	0.7200	0.7000	0.7700	3.3103	(81)
Northwest	1.5700	26.0000	0.7200	0.7000	1.0000	18.5160	(82)

Solar gains	206.5905	364.5682	527.9823	695.7523	811.9284	818.9928	784.3175	696.6040	586.4123	411.2222	249.8635	175.1764	(83)
Total gains	859.1558	1014.4535	1156.2362	1280.3954	1353.4182	1326.8921	1272.5670	1189.6325	1105.6791	969.0794	850.3265	811.3379	(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	17.9889	18.0351	18.0807	18.2977	18.3388	18.5330	18.5330	18.5694	18.4577	18.3388	18.2557	18.1696	
alpha	2.1993	2.2023	2.2054	2.2198	2.2226	2.2355	2.2355	2.2380	2.2305	2.2226	2.2170	2.2113	
util living area													
	0.9261	0.8956	0.8483	0.7720	0.6669	0.5349	0.4170	0.4547	0.6307	0.8077	0.8998	0.9336	(86)
Living	19.8243	19.9247	20.0739	20.2542	20.4050	20.5133	20.5592	20.5518	20.4704	20.2693	20.0164	19.8085	
Non living	18.5671	18.6670	18.8134	18.9960	19.1346	19.2358	19.2674	19.2659	19.2008	19.0176	18.7714	18.5621	
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	20.3986	19.9247	20.0739	20.2542	20.4050	20.5133	20.5592	20.5518	20.4704	20.2693	20.0164	19.9751	(87)
Th 2	19.6545	19.6575	19.6604	19.6739	19.6765	19.6884	19.6884	19.6906	19.6838	19.6765	19.6713	19.6660	(88)
util rest of house													
	0.9146	0.8797	0.8250	0.7360	0.6116	0.4524	0.3087	0.3457	0.5529	0.7689	0.8818	0.9232	(89)
MIT 2	19.0982	18.6670	18.8134	18.9960	19.1346	19.2358	19.2674	19.2659	19.2008	19.0176	18.7714	18.7165	(90)
Living area fraction											fLA = Living area / (4) =	0.4778	(91)
MIT	19.7195	19.2679	19.4156	19.5971	19.7415	19.8462	19.8846	19.8803	19.8074	19.6157	19.3662	19.3178	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7195	19.2679	19.4156	19.5971	19.7415	19.8462	19.8846	19.8803	19.8074	19.6157	19.3662	19.3178	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9152	0.8745	0.8202	0.7337	0.6145	0.4631	0.3260	0.3627	0.5610	0.7669	0.8771	0.9201	(94)
Useful gains	786.2824	887.1174	948.3547	939.3903	831.7109	614.4772	414.8339	431.4367	620.2879	743.1765	745.8166	746.4765	(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													
	2142.9176	1991.6565	1785.8358	1461.5456	1096.2444	707.6829	443.0700	468.5488	773.0354	1229.0393	1679.7758	2080.0975	(97)
Space heating kWh													
	1009.3366	742.2503	623.0860	375.9518	196.8130	0.0000	0.0000	0.0000	0.0000	361.4820	672.4507	992.2140	(98a)
Space heating requirement - total per year (kWh/year)												4973.5843	
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													
	1009.3366	742.2503	623.0860	375.9518	196.8130	0.0000	0.0000	0.0000	0.0000	361.4820	672.4507	992.2140	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4973.5843	
Space heating per m2											(98c) / (4) =	55.2620	(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 %)	310.3961	(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													
	1009.3366	742.2503	623.0860	375.9518	196.8130	0.0000	0.0000	0.0000	0.0000	361.4820	672.4507	992.2140	(98)
Space heating efficiency (main heating system 1)													
	310.3961	310.3961	310.3961	310.3961	310.3961	0.0000	0.0000	0.0000	0.0000	310.3961	310.3961	310.3961	(210)
Space heating fuel (main heating system)													
	325.1769	239.1300	200.7390	121.1200	63.4070	0.0000	0.0000	0.0000	0.0000	116.4583	216.6427	319.6606	(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													
	291.2201	241.2289	212.5740	149.8717	109.9918	94.4606	90.9351	112.9368	149.2957	209.1473	256.6333	287.7394	(64)
Efficiency of water heater												271.6210	(216)
(217)m	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	271.6210	(217)
Fuel for water heating, kWh/month													
	107.2156	88.8109	78.2613	55.1768	40.4946	34.7766	33.4787	41.5788	54.9647	76.9997	94.4821	105.9342	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.2192	22.6385	20.3835	14.9338	11.5353	9.4244	10.5229	13.6780	17.7664	23.3105	26.3292	29.0035	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-38.7155	-57.7096	-86.4511	-98.6290	-104.0154	-89.8891	-88.5827	-83.6116	-74.2395	-65.6108	-43.2348	-33.0368	(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	-11.3710	-25.8703	-55.8952	-92.1430	-131.6673	-141.8246	-140.0689	-116.1624	-82.2236	-41.2351	-16.1750	-8.8771	(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												1602.3346	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												271.6210	
Water heating fuel used												812.1739	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
pump for solar water heating												80.0000	(230g)
Total electricity for the above, kWh/year												80.0000	(231)
Electricity for lighting (calculated in Appendix L)												227.7452	(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												995.0142	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1602.3346	16.4900	264.2250	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	812.1739	16.4900	133.9275	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	227.7452	16.4900	37.5552	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-863.7259	16.4900	-142.4284	
PV Unit electricity exported	-863.5135	5.5900	-48.2704	
Total			-190.6988	(252)
Total energy cost			258.2008	(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] =	0.6885	(257)
SAP value		88.8388	
SAP rating (Section 12)		89	(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	1602.3346	0.1550	248.3236	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	812.1739	0.1455	118.1533	(264)
Space and water heating			366.4769	(265)

Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	227.7452	0.1443	32.8707 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-863.7259	0.1349	-116.4828
PV Unit electricity exported	-863.5135	0.1227	-105.9489
Total			-222.4317 (269)
Total CO2, kg/year			188.0129 (272)
CO2 emissions per m2			2.0900 (273)
EI value			98.1338
EI rating			98 (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	90.0000	(1b)	x 3.7300	(2b) =	335.7000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	335.7000	(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) =	0.1192	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3192	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3192	(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	0.3670	0.3351	0.3271	0.3192	0.3351	0.2952	0.3112	0.2952	0.2952	0.3192	0.3112	0.3271	(22b)
Effective ac	0.5674	0.5561	0.5535	0.5509	0.5561	0.5436	0.5484	0.5436	0.5436	0.5509	0.5484	0.5535	(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								
Windows			17.0100	1.2357	21.0200			(27)
Door			2.1000	1.3000	2.7300			(26a)
Roof light			1.5700	1.3258	2.0814			(27a)
Heatloss Floor 1			90.0000	0.1200	10.8000			(28a)
External Wall 1	108.0000	19.1100	88.8900	0.1600	14.2224			(29a)
External Wall in roof	9.2000		9.2000	0.1800	1.6560			(29a)
External Roof Warm	135.0000	1.5700	133.4300	0.1200	16.0116			(30)
Total net area of external elements Aum(A, m2)			342.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.5214			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.8000	0.0250	0.3200
E3 Sill	11.8000	0.0220	0.2596
E4 Jamb	33.6000	0.0170	0.5712
E5 Ground floor (normal)	45.0000	0.0700	3.1500
E16 Corner (normal)	21.6000	0.0420	0.9072
R1 Head of roof window	1.6000	0.2400	0.3840
R2 Sill of roof window	1.6000	0.2400	0.3840
R3 Jamb of roof window	3.9200	0.2400	0.9408
E17 Corner (inverted - internal area greater than external area)	21.6000	-0.0850	-1.8360
E11 Eaves (insulation at rafter level)	45.0000	0.0180	0.8100
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			5.8908 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.4122 (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	62.8521	61.6108	61.3182	61.0325	61.6108	60.2180	60.7540	60.2180	60.2180	61.0325	60.7540	61.3182	(38)

Heat transfer coeff

	137.2643	136.0230	135.7304	135.4447	136.0230	134.6302	135.1662	134.6302	134.6302	135.4447	135.1662	135.7304 (39)
Average = Sum(39)m / 12 =												135.4903

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.5252	1.5114	1.5081	1.5049	1.5114	1.4959	1.5018	1.4959	1.4959	1.5049	1.5018	1.5081	(40)
HLP (average)												1.5054	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6257 (42)
Hot water usage for mixer showers												
	85.3056	84.0236	82.1555	78.5812	75.9435	73.0020	71.3300	73.1840	75.2162	78.3746	82.0256	84.9787 (42a)
Hot water usage for baths												
	29.4706	29.0329	28.4165	27.2801	26.4292	25.4856	24.9760	25.5880	26.2544	27.2640	28.4238	29.3709 (42b)
Hot water usage for other uses												
	41.5200	40.0102	38.5004	36.9905	35.4807	33.9709	33.9709	35.4807	36.9905	38.5004	40.0102	41.5200 (42c)
Average daily hot water use (litres/day)												143.7182 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	156.2961	153.0667	149.0724	142.8519	137.8534	132.4585	130.2769	134.2527	138.4612	144.1390	150.4596	155.8697	(44)
Energy conte	247.5349	217.9649	229.1188	195.5571	185.5772	162.8732	157.5586	166.2329	170.7365	195.5952	214.3573	244.0542	(45)
Energy content (annual)										Total = Sum(45)m =		2387.1608	
Distribution loss (46)m = 0.15 x (45)m													
	37.1302	32.6947	34.3678	29.3336	27.8366	24.4310	23.6338	24.9349	25.6105	29.3393	32.1536	36.6081	(46)
Water storage loss (or HIU loss):													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6588	(55)
Total storage loss													
	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(56)
If cylinder contains dedicated solar storage													
	20.4228	18.4464	20.4228	19.7640	20.4228	19.7640	20.4228	20.4228	19.7640	20.4228	19.7640	20.4228	(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													
	291.2201	257.4225	271.4082	231.0795	216.4681	192.5425	188.2168	197.8216	207.6096	237.8847	256.6333	287.7394	(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												794.3793	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												794.3793	
Solar input	-6.2712	-24.0621	-70.5631	-97.5796	-120.3466	-118.7770	-118.1934	-105.8196	-77.1666	-45.0350	-10.5651	-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													
	284.9489	233.3604	200.8451	133.4999	96.1216	73.7654	70.0234	92.0020	130.4430	192.8497	246.0682	287.7394	(64)
										Total per year (kWh/year) = Sum(64)m =		2041.6671	(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													
	117.2535	104.0394	110.0136	93.4407	86.4171	77.8908	76.9148	80.5434	86.2684	98.8670	105.0946	116.0962	(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	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	157.5432	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	32.2397	28.6350	23.2876	17.6302	13.1788	11.1261	12.0221	15.6268	20.9742	26.6316	31.0830	33.1357	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	356.8324	360.5352	351.2043	331.3398	306.2645	282.6972	266.9528	263.2500	272.5809	292.4454	317.5208	341.0881	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	53.3800	(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)													
	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	-105.0288	(71)
Water heating gains (Table 5)													
	157.5988	154.8206	147.8677	129.7787	116.1521	108.1816	103.3802	108.2573	119.8172	132.8857	145.9647	156.0433	(72)
Total internal gains													
	652.5654	649.8853	628.2540	584.6432	541.4898	507.8993	488.2495	493.0285	519.2668	557.8572	600.4630	636.1615	(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	
Northeast	1.4700	15.4726	0.7200	0.7000	0.7700	7.9441	(75)
East	3.0000	26.6540	0.7200	0.7000	0.7700	27.9285	(76)
Southeast	2.8800	47.7150	0.7200	0.7000	0.7700	47.9967	(77)
South	2.3100	59.9148	0.7200	0.7000	0.7700	48.3404	(78)
Southwest	6.5100	47.7150	0.7200	0.7000	0.7700	108.4925	(79)
Northwest	0.8400	15.4726	0.7200	0.7000	0.7700	4.5395	(81)
Northwest	1.5700	36.0000	0.7200	0.7000	1.0000	25.6375	(82)

Solar gains	270.8792	404.0453	579.5888	787.4570	890.9053	963.1340	925.3297	821.4786	692.1331	486.6209	315.6928	228.9767	(83)
Total gains	923.4446	1053.9305	1207.8428	1372.1001	1432.3951	1471.0334	1413.5793	1314.5071	1211.4000	1044.4781	916.1558	865.1382	(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	18.2130	18.3792	18.4189	18.4577	18.3792	18.5694	18.4958	18.5694	18.5694	18.4577	18.4958	18.4189	
alpha	2.2142	2.2253	2.2279	2.2305	2.2253	2.2380	2.2331	2.2380	2.2380	2.2305	2.2331	2.2279	
util living area	0.9063	0.8778	0.8198	0.7214	0.5912	0.4239	0.2987	0.3176	0.5252	0.7419	0.8646	0.9138	(86)
Living	19.9264	20.0072	20.1584	20.3310	20.4677	20.5527	20.5785	20.5779	20.5251	20.3661	20.1374	19.9278	
Non living	18.6798	18.7667	18.9132	19.0749	19.1892	19.2644	19.2739	19.2789	19.2479	19.1120	18.9016	18.6933	
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	20.4508	20.0072	20.1584	20.3310	20.4677	20.5527	20.5785	20.5779	20.5251	20.3661	20.1374	20.0778	(87)
Th 2	19.6687	19.6790	19.6814	19.6838	19.6790	19.6906	19.6861	19.6906	19.6906	19.6838	19.6861	19.6814	(88)
util rest of house	0.8914	0.8591	0.7922	0.6784	0.5248	0.3325	0.1861	0.1992	0.4324	0.6892	0.8395	0.8997	(89)
MIT 2	19.1628	18.7667	18.9132	19.0749	19.1892	19.2644	19.2739	19.2789	19.2479	19.1120	18.9016	18.8315	(90)
Living area fraction										fLA = Living area / (4) =		0.4778	(91)
MIT	19.7782	19.3594	19.5081	19.6750	19.8000	19.8799	19.8972	19.8995	19.8581	19.7112	19.4920	19.4270	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7782	19.3594	19.5081	19.6750	19.8000	19.8799	19.8972	19.8995	19.8581	19.7112	19.4920	19.4270	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8928	0.8540	0.7881	0.6780	0.5314	0.3465	0.2050	0.2190	0.4452	0.6904	0.8353	0.8966	(94)
Useful gains	824.4389	900.0548	951.9366	930.3381	761.1854	509.6918	289.7466	287.8893	539.3507	721.1477	765.2217	775.7251	(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	1987.3364	1857.9902	1643.4389	1323.9788	924.9617	549.2823	296.9920	296.1212	613.6586	1044.4376	1485.7484	1890.3128	(97)
Space heating kWh	865.1957	643.7326	514.4778	283.4213	121.8495	0.0000	0.0000	0.0000	0.0000	240.5276	518.7792	829.2533	(98a)
Space heating requirement - total per year (kWh/year)												4017.2371	
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	865.1957	643.7326	514.4778	283.4213	121.8495	0.0000	0.0000	0.0000	0.0000	240.5276	518.7792	829.2533	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4017.2371	
Space heating per m2											(98c) / (4) =	44.6360	(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 %)												309.0847	(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	865.1957	643.7326	514.4778	283.4213	121.8495	0.0000	0.0000	0.0000	0.0000	240.5276	518.7792	829.2533	(98)
Space heating efficiency (main heating system 1)	309.0847	309.0847	309.0847	309.0847	309.0847	0.0000	0.0000	0.0000	0.0000	309.0847	309.0847	309.0847	(210)
Space heating fuel (main heating system)	279.9219	208.2706	166.4520	91.6970	39.4227	0.0000	0.0000	0.0000	0.0000	77.8193	167.8437	268.2932	(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	284.9489	233.3604	200.8451	133.4999	96.1216	73.7654	70.0234	92.0020	130.4430	192.8497	246.0682	287.7394	(64)
Efficiency of water heater												271.4953	(216)
(217)m	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	271.4953	(217)
Fuel for water heating, kWh/month	104.9554	85.9538	73.9774	49.1721	35.4045	27.1701	25.7918	33.8871	48.0461	71.0324	90.6344	105.9832	(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	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945	(231)
Lighting	28.2192	22.6385	20.3835	14.9338	11.5353	9.4244	10.5229	13.6780	17.7664	23.3105	26.3292	29.0035	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.9888	-62.7205	-91.7575	-104.3231	-105.9863	-96.0937	-94.8144	-90.3875	-81.7467	-72.9688	-52.1880	-41.8038	(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	-17.6809	-31.3012	-66.5027	-113.4019	-153.8222	-177.2506	-175.9608	-146.7791	-104.9903	-55.2976	-24.0183	-13.8063	(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												1299.7203	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												271.4953	

Water heating fuel used	752.0084	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	227.7452	(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	334.8829	(238)

10a. Fuel costs - using BEDF prices (590)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1299.7203	28.4300	369.5105	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	752.0084	28.4300	213.7960	(247)
Energy for instantaneous electric shower(s)	0.0000	28.4300	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	28.4300	22.7440	(249)
Energy for lighting	227.7452	28.4300	64.7480	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-943.7790	28.4300	-268.3164	
PV Unit electricity exported	-1080.8120	5.8100	-62.7952	
Total			-331.1115	(252)
Total energy cost			339.6869	(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	1299.7203	0.1557	202.3938	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	752.0084	0.1467	110.2856	(264)
Space and water heating			312.6794	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	227.7452	0.1443	32.8707	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-943.7790	0.1353	-127.7380	
PV Unit electricity exported	-1080.8120	0.1229	-132.8306	
Total			-260.5686	(269)
Total CO2, kg/year			96.0785	(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	1299.7203	1.5765	2049.0075	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	752.0084	1.5425	1159.9974	(278)
Space and water heating			3209.0049	(279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240	(281)
Energy for lighting	227.7452	1.5338	349.3232	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-943.7790	1.5003	-1415.9205	
PV Unit electricity exported	-1080.8120	0.4508	-487.2794	
Total			-1903.1999	(283)
Total Primary energy kWh/year			1776.1522	(286)

Predicted Energy Assessment

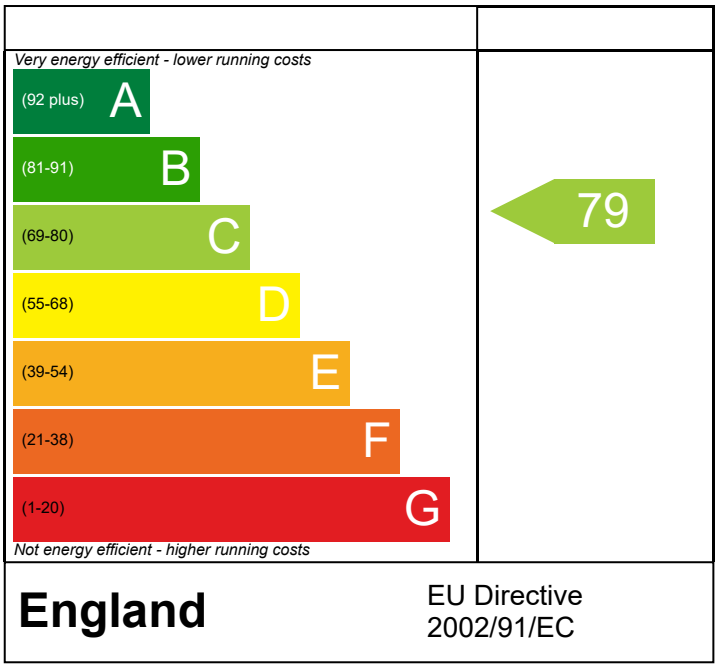
45, Hulbert Road , Havant, Hampshire , PO9 3TA

Dwelling type:	Bungalow, Detached
Date of assessment:	25/02/2026
SAP Version:	10.2
Produced by:	Rachel Mitchell
Total floor area:	90 m²
DRRN:	0315-2602-2564

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

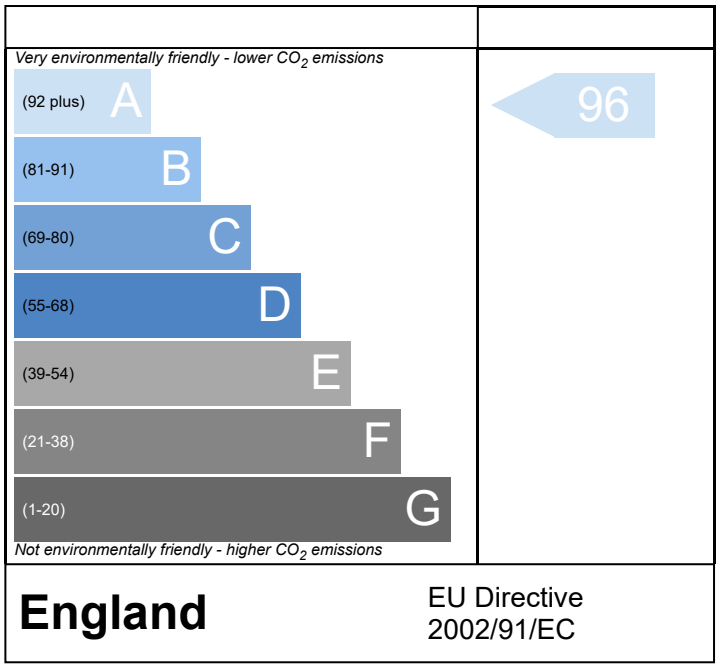
The energy performance has been assessed using the Government approved SAP 10 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

1 APPENDIX TWO: PART O COMPLIANCE

Building Regulations Part O 2021 (England), Simplified Method - Results

Is dwelling in a location where external noise may be an issue?	**No**
Is dwelling located near to significant local pollution sources?	**No**
Direction of house type plan 'clock face 6' on site wide plan	**South**

Future Homes Hub spreadsheet tool version: FHH-SM-V2

A Site data								
Company	Greenbox Associates Ltd							
Site	45 Hulbert Road							
House type	Detached Bungalow							
Plot number								
B Home data								
Location risk category	**Moderate Risk**							
Shading provided?	**None**							
Cross ventilation?	**Yes**							
Total GIA of home (m^2)	**89.47**							
Largest glazed façade orientation	**South**							
C Results	**Value**		**Percentage**		**Target**		**RESULT**	✓×
Limiting solar gains:								
Total glazing area for home	13.13	m^2	14.67	%	15	%	Target met	✓
Glazing area for most glazed room: **Living/ Kitchen/ Dining**	6.60	m^2	15.36	%	30	%	Target met	✓
Shading	None				Not required			✓
Removal of excess heat:								
Total equivalent area (% of floor area)	13.35	m^2	14.92	%	9	%	Target met	✓
Total equivalent area (% of glazed area)	13.35	m^2	101.68	%	55	%	Target met	✓
Bedroom 1 equivalent area	1.03	m^2	6.06	%	4	%	Target met	✓
Bedroom 2 equivalent area	0.64	m^2	5.37	%	4	%	Target met	✓
Bedroom 3 equivalent area		m^2		%		%		
Bedroom 4 equivalent area		m^2		%		%		
Bedroom 5 equivalent area		m^2		%		%		
Bedroom 6 equivalent area		m^2		%		%		