MACH GROUP | ENERGY

KINGSTON BROADWAY, SHOREHAM-BY-SEA

Sustainability and Energy Statement

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Sustainability and Energy Statement

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1.0 INTRODUCTION

This report provides a sustainability and energy statement in relation to the proposed development at Kingston Broadway in Shoreham-by-Sea.

This document details the methodology and assessment of the sustainable and low carbon design of the proposed new build development.

2.0 PROPOSED DEVELOPMENT

The development is understood to be a new build construction that will include a total of 5 houses.

All geometry and construction information of the development has been received from Mark Alford Design.

3.0 LOCAL COUNCIL POLICIES

This Sustainability and Energy Statement has been compiled to demonstrate compliance with the following Adur Council Policies from the Adur Local Plan 2017 – Compete Document:

3.1 Policy 18: Sustainable Design Residential:

All new dwellings must achieve a water efficiency standard of no more than 110 litres/person/day (lpd).

Non-residential: Non-domestic floorspace must achieve a minimum standard of BREEAM 'Very Good' with a specific focus on water efficiency.

Developers will be expected to provide certification evidence of the levels for BREEAM at the design stage and on completion of development.

3.2 Policy 19: Decentralised Energy, Stand-alone Energy Schemes and Renewable Energy.

An assessment of the opportunities to use low carbon energy, renewable energy, and residual heat/ cooling for both domestic and non-domestic developments must be provided with any major planning application.8 This must include details of:

- Any new opportunities for providing or creating new heating/cooling networks.
- The feasibility of connecting the development to existing heating / cooling / CHP networks where these already exist.
- Opportunities for expansion of any proposed networks beyond the development area over time, and to plan for potential expansion.

Where viable and feasible, commercial, and residential developments in areas identified in the Shoreham Harbour Heat Network Study (2015) will be expected to connect to district heating networks where they exist.

Stand-alone energy schemes will also be supported subject to compliance with other policies in this Plan.

All new major development will be expected to incorporate renewable/low carbon energy production equipment to provide at least 10% of predicted energy requirements.

3.3 Adur District Council, SPD: Sustainable Energy

Following, aspects of the Adur District Council Supplementary Planning Document on the Sustainable Energy have been considered:

This supplementary planning document provides further detail on how to demonstrate the proposal's contribution to reducing carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy

The sustainable energy is an integral part of the development's design and evolution. Smaller developments are also encouraged to meet the standard and follow on the improvements.

<u>Heating and cooling networks</u>
All proposals for major development must include an assessment of the opportunities for decentralised heating and cooling networks.

<u>Shoreham Heat Network Area</u>
Shoreham Heat Network Partnership is exploring the potential for a heat network serving parts of Shoreham-by-Sea town centre and Shoreham Harbour. All development in this area will be required to connect to the network once it is complete. Heating/cooling systems must therefore be designed to be compatible with future connection to a network.

<u>Renewable and low carbon energy generation</u>
Building related energy consumption is a significant contributor to greenhouse gas emissions. The hierarchy of reducing demand; using energy efficiently; supplying energy efficiently and then using appropriate on-site renewable/low carbon energy generation is the most cost-effective means of reducing energy consumption and greenhouse gas emissions for new developments.

All major development is expected to incorporate renewable/low carbon generation of a minimum of 10% of predicted energy requirements. However smaller developments are encouraged to meet the standards for the improvements.

4.0 CLIMATE CHANGE & SUSTAINABILE ENERGY

4.1 Encouraging Greener Transport Use

Proposed development is in a central location, within walking distance to offices, shops, cafes, restaurants, and post offices, with public parks and green areas to the north, south, east, and west. The nearest bus stop is located less than 100m away, with easy links to the city centre and harbour.

The proximity of these amenities and the proposed facilities should discourage car journeys for potential future residents. This should help to reduce emissions and congestion associated with motorised transport.

4.2 Site Layout and Design - Resilience to Climate Change

The dwellings have been designed as dual aspect such that cross ventilation is possible from the east and west facades through openable windows. This will help to reduce the need for mechanical ventilation now and in the case of a potentially warmer future climate. The development also benefits from reasonable solar shading from the surrounding buildings.

Furthermore, additional resilience against overheating can be achieved by using appropriate internal shading such as blinds and curtains.

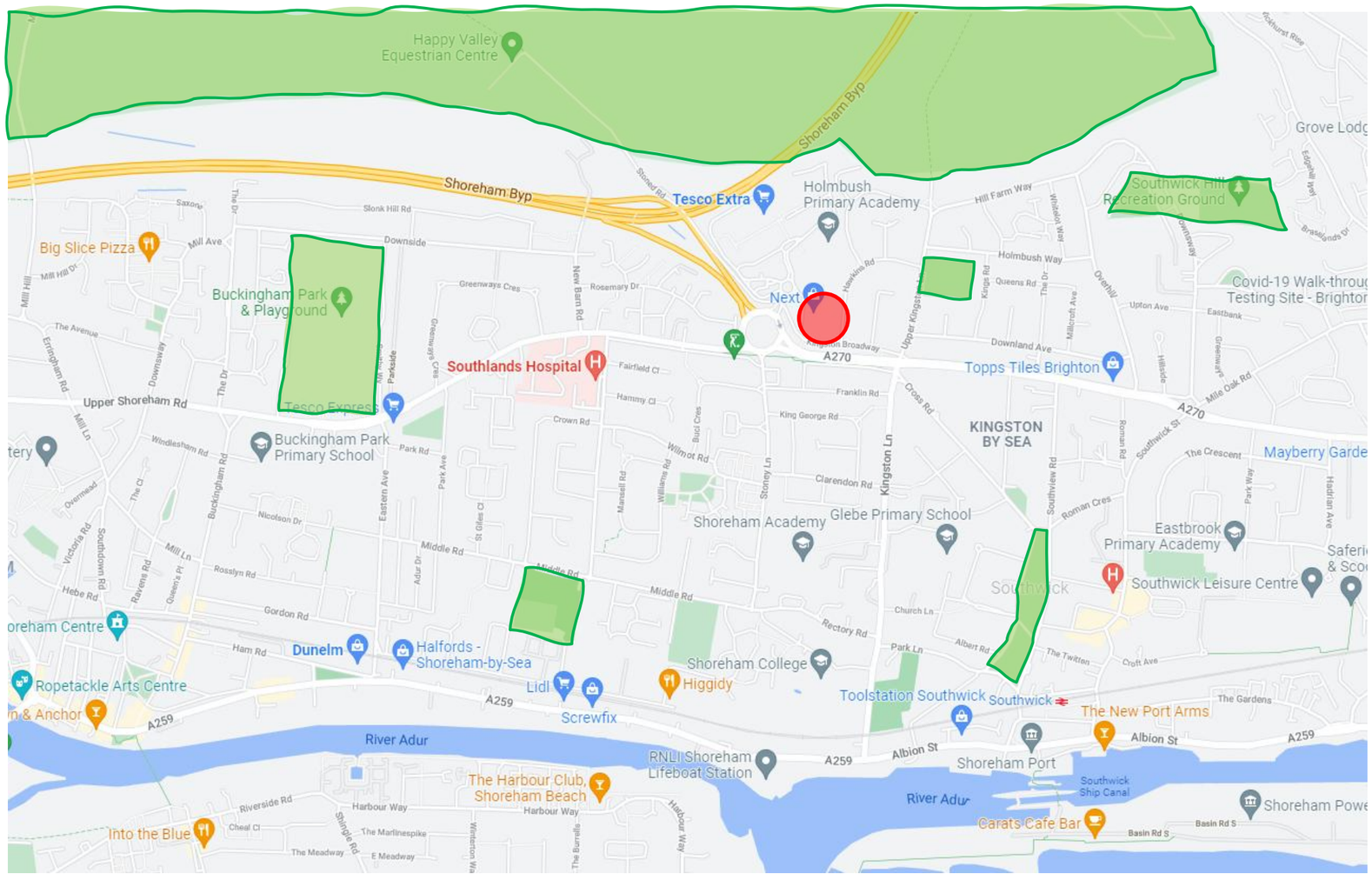

Figure 4.1: Site location and adjacent amenities

5.0 ENERGY USE

The thermal elements and fenestration have been designed to meet and exceed the standards set out in Approved Document L1(2021 version). Well specified thermal elements with low U-values help to reduce energy demand and improve comfort levels within the property , while new, highly efficient systems will be installed to provide heating, hot water and ventilation to the building.

Following the methodology outlined in the Climate Change and Sustainability – Practice Note, SAP calculations have been completed in the Be Lean, Be Clean and Be Green methodology to demonstrate a reduction in regulated carbon emissions.

5.1 Methodology

SAP calculations achieving Part L compliance were modelled to provide 'baseline' energy demand and emissions. Additional measures were applied to provide 'residual' energy demand and emissions. Finally, appropriate decentralised renewables were included in the SAP calculations to provide the final energy demand and emissions figures for comparison.

5.2 Be Lean - Proposed Building Fabric

The development has been modelled to comply with all thermal and energy requirements of Building Regulations Part L1A. The thermal elements of the building fabric are provided in the table opposite.

All non-repeating thermal bridges (e.g. between the external walls and the roofs) of any new construction will be specified to Accredited Construction Details. This will ensure that heat losses through these junctions are minimised.

5.2.1 Glazing

The glazing design allows for passive heating into the building. However, careful consideration will be given to the fenestration, particularly those to the rear of the flats where the risk of overheating is greatest. Low 'g' value glazing can be specified. Furthermore, to minimise the risk of overheating within the dwellings, the glazing will be openable where practical and internal shading will be employed. Also, low U-values will need to be specified to limit heat losses through these areas.

The positioning of the glazed openings will also maximise the available daylight to the living/dining areas. This will not only improve comfort levels for the occupants but also reduce the energy consumption through artificial lighting.

5.2.2 Lighting

It is proposed that only energy efficient lighting is installed at the property. This means that all light fittings should have lamps with a luminous efficacy equal to or greater than 80 lamp lumens per circuit -watt.

5.2.3 Ventilation

Mechanical Heat Recovery Ventilation (MVHR) units are proposed for all dwellings. This will provide low energy background ventilation throughout the year, and will reduce heating demand through the use of heat recovery.

The design of both buildings allows for cross ventilation to mitigate overheating during the summer months, however the MVHR units can provide additional cooling through the use of a summer bypass mode and higher 'boost' flow rates.

Category	Description	Value
Building Fabric U Value (W/m^2K)	External Walls	0.15
	Ground Floor	0.12
	Exposed Floor	0.12
	Pitched Roof	0.12
	Doors	1.00
	Windows	1.30
	Rooflights	1.30
Glazing g-value	Windows and Rooflights	0.5
Air Tightness		4 m^3/m^2.h@50Pa
Ventilation	Mechanical Ventilation Heat Recovery	Nuaire MRXBOX 86% heat recovery
Primary Heating (Dwellings)	Combi Gas Boiler*	Winter Efficiency 92.4% Winter Efficiency 80.3%
Heating Controls (Dwellings)	Programmer, room thermostats and TRVs	
Water Heating	From the Main Heating System	
Low Energy Lighting	LED Lighting	100%
Water Use	Water saving strategy and calculation, to be updated and re-modelled during detailed design stages	<= 110 l/person/day
*Notional Part L value for comparing building fabric improvements. See Table 5.3 for proposed M&E strategy.		

Table 5.1: Proposed U-Values and building services - Be Lean

5.3 Be Clean – District Heating

There are currently no available district heat networks in the vicinity of the proposed development.

It is important to note however that a feasibility study ('Shoreham Harbour Heat Network Study – 2016") has been carried out for a district heating network within Shoreham. A number of different options have been assessed in the study, in which one option, shown opposite (Scenario A, Phase 3) shows the extension of the heat network near to the proposed development. It is also important to note that if this scenario where to be taken forward, the expected build date is 2035.

As little information is currently available on which heat network scenario is to be taken forward, or how it is to be provided, it is not possible to include this within the energy strategy for the proposed development.

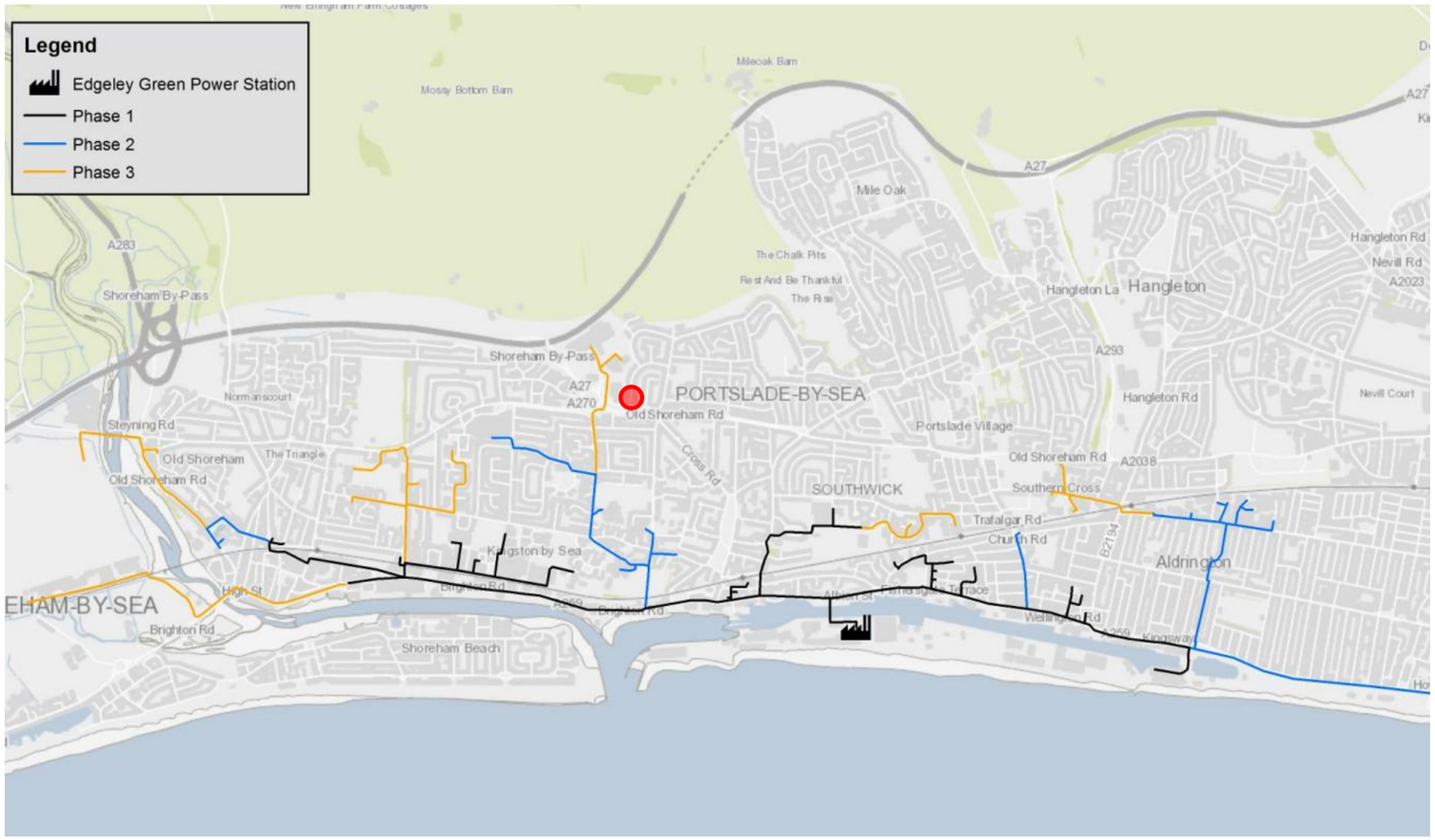

Figure 5.1: Shoreham Heat Network Study – Scenario A, Phase 3

5.4 Be Green - Renewable Technology Feasibility

Renewable technology options have been evaluated in the table opposite in regard to limitations of the specific site situation and context, and key considerations for the technology.

Due to the location, size and type of development some renewable technologies are not appropriate for this site.

It is seen that both photovoltaic panels and air source heat pumps are suitable for the site and have been adopted with the energy strategy.

Photovoltaic panels are to be located on each pitched roof with South exposure. It is anticipated that the PV panels would be designed as an array for each dwelling individually. Orientation of the building, and proposed roof design, in addition to limited overshading from other constructions, ensures the effectiveness of solar systems.

To reduce risk of noise pollution to adjacent dwellings, internal Air Source Heat Pump boilers have been specified to each dwelling. Each unit will be ducted externally and will provide high efficiency hot water.

Further information on the renewable technology proposals are provided on the following page.

Building Characteristics	Uses	Scale	Consideration	Applicable to the Project?
Photovoltaic Panels				
Roof facing east to west (through south) and not overshadowed, flat roof or pitched around 30o	All uses. Especially suitable for where extensive IT use and / or lighting. E.g. offices, schools	All scales	To maximize potential, need to consider orientation	Yes. Roof space and exposure provide an opportunity for this system
Solar Thermal				
Roof faces east to west (through south), hot water tank needed.	All uses	All scales. Can be used with other fuel sources to pre-heat water and so reduce fuel consumption	Needs a demand for hot water – domestic, showers, washrooms	Yes. Roof space and exposure provide an opportunity for this system
Air Source Heat Pumps				
Most units requires space for an external unit away from nearby sensitive spaces. Internal ASHP units require ductwork to the external façade.	Any	Any, but more likely to be appropriate at small scale	Careful siting needed to reduce aesthetic impact. Potential noise impact. Powered by electricity, so lower carbon reduction than other technologies.	Yes. Close proximity to adjacent dwellings (noise) needs to be considered.
Biomass				
Space needed for plant, fuel storage and deliveries	Mixed use, schools, offices, commercial, residential – especially multi-residential – best constant energy demand	Medium to large, viable where heat demand is above 15 kW, can be combined with gas for summer / back-up use	Air quality impact. Impact of deliveries on residents. Fuel source (is supply secured). Distance transported.	No. Limited space for plant and fuel storage, and development too small scale.
Ground Source Heat Pumps				
External space for horizontal trench or vertical borehole	Any	Medium to large	Archaeology. Usually combined with underfloor heating, so slow to respond. Can combine with landscaping.	No. Limited external space.
Combined Heat and Power (CHP)				
Single energy center providing heat and power – needs space for access and servicing	Hospitals, leisure centers, educational buildings, large scale residential and mixed use.	Large	Needs substantial head demand to be viable.	No. Development too small scale.
District Heating				
One or more energy centers with heat distribution network	Residential / mixed use	Very Large	Needs substantial heat demand to be viable, can be combined with gas boilers to respond to demand variations.	No. Development too small scale. Potential access to proposed district heating supply in the future.

Table 5.2: Renewable technology feasibility

5.4.1 Photovoltaic Panels

The proposed photovoltaic panels are estimated to provide a 1.65kW$_{peak}$ of energy per dwelling. Each system would consist of five 330W$_{peak}$ panels. Batteries and diverters have not been included within the energy strategy.

The proposed roof plan with indicative rooftop PV area is shown opposite.

5.4.2 Air Source Heat Pumps

The Air Source Heat Pump units modelled in the development are based upon Dimplex Edel 270 units. Units will be located internally and ducted to the external wall. Each unit provides high efficiency hot water, with a Coefficient of Performance of 3.30.

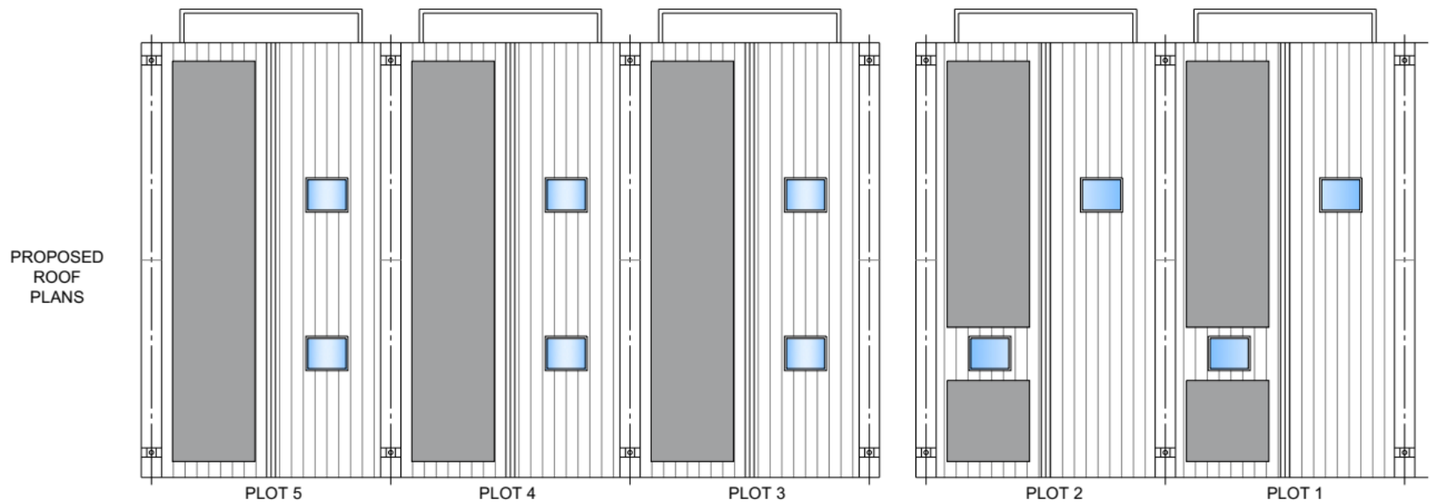

Figure 5.2: Proposed roof plans – rooftop PV panels

Category	Description	Product/Efficiency
Ventilation	Mechanical Ventilation Heat Recovery	Nuaire MRXBOX 86% heat recovery
Primary Heating (Dwellings)	Electric Panel Heaters	100%
Heating Controls (Dwellings)	N/A	
Water Heating	ASHP Boiler	Dimplex Edel 270 litre COP 3.30
Low Energy Lighting	LED Lighting	100%
Renewable Technologies	PV Panels	1.65KW peak for each dwelling consisting of 5no 330W panels

Table 5.3: Proposed U-Values and building services – Be Green

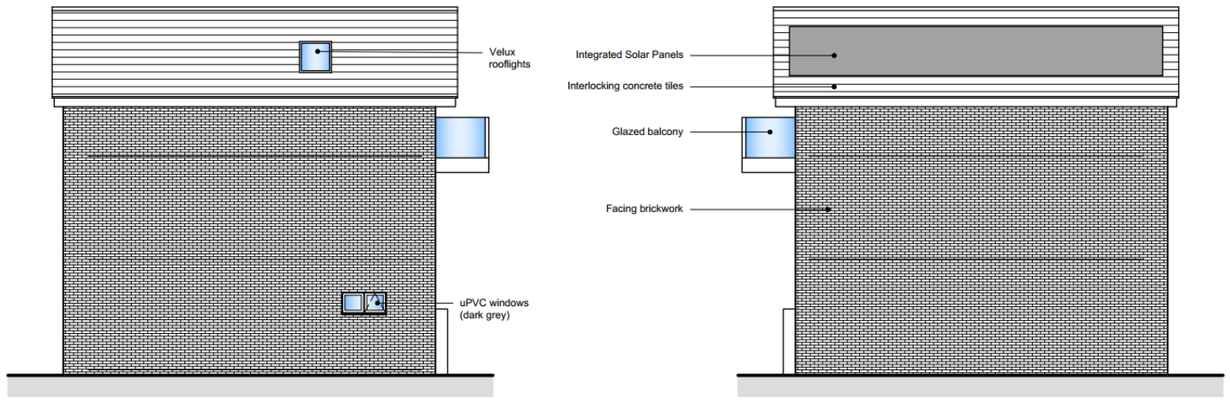

Figure 5.3: Proposed elevations – rooftop PV panels

5.5 Performance of the Proposed Development

To demonstrate compliance with Building Regulations, The Standard Assessment Procedure (SAP) methodology was adapted and utilized, to compare the energy and environmental performance of the assessed dwellings.

The Energy Statement Report demonstrates a hierarchical approach to energy consumption, composed of:

- *Be Lean (Use Less Energy)*
- *Be Clean (Supply Energy Efficiently)*
- *Be Green (Use Renewable Energy)*

5.5.1 Be Lean – Good Passive Design & Minimizing Energy Demand

The following design measures have been incorporated into the scheme:

- Improvements upon U-values above Part L requirements
- Improved airtightness to reduce thermal leakage
- Good daylighting to reduce electrical lighting demand
- Balancing solar gains and shading requirements

5.5.2 Be Clean – Low Energy Heating and Cooling

It was noted that the proposed new development is located outside of any existing heat networks however there are plans to develop district heating network in the future.

5.5.3 Be Green – Renewable Sources of Energy

To help reduce CO_2 emissions, and decrease use of primary energy, the scheme is to incorporate a system of photovoltaic panels, to ensure offset in electricity usage. Air source heat pumps will also be used to provide low carbon hot water.

5.6 Outcome

The table below presents the results of the energy calculations as per the Be Lean, Be Clean and Be Green methodology. It is shown that a total reduction of 59% is achieved from all proposed carbon saving measures, equaling a saving of 5.34 Tonnes CO_2/year.

	Energy Demand (MWh/m² pa)	Regulated CO_2 Emissions (TonnesCO_2/year)	CO_2 Saved (TonnesCO_2/year)	Saving Achieved On Residual CO_2 Emissions (%)
Baseline Part L Requirements	43.4	9.00		
Good Passive Design & Minimizing Energy Demand (Be Lean)	39.5	7.95	1.05	12%
Low Energy Heating and Cooling (Be Clean)	39.5	7.95	-	0%
Proposed Scheme After On-Site Renewables (Be Green)	23.8	3.65	4.29	48%
Total Savings on Residual Emissions			5.34	59%

Table 5.4: Overall energy demand and CO_2 emissions of the proposed development

6.0 SUSTAINABLE DESIGN & CONSTRUCTION

6.1 Green Infrastructure and Biodiversity Enhancement

This development is of a small-scale so the concern of contributing to heating the urban environment is not significant.

There is little scope to enhance biodiversity on this project. The aim will be to introduce a small amount of planting if required.

6.2 Avoiding Responses to Climate Impacts that Lead to Increases in Energy Use and CO_2 Emissions

There are no proposals to include artificial cooling as part of these works. Cross ventilation and appropriate internal shading such as blinds and curtains will be used to mitigate against the effects of overheating from the sun. Although well specified, the thermal envelope is not designed so as to require mechanical ventilation and cooling.

6.3 Site Layout and Design - Flexibility and Adaptability

The proposed development makes efficient use of the available site area whilst minimizing shadowing or overbearing impact upon adjacent properties. Depending on the future needs of the local area, the building could be expanded to include additional flats if required.

7.0 FLOOD RISK & WATER MANAGEMENT

7.1 Minimising Flood Risk

A separate Flood Risk Assessment has been carried out and will be submitted as part of the planning application.

7.2 Water Conservation

Internal potable water will be conserved by installing flow restrictors to taps and showers, installing dual flush toilets and a low capacity bath.

The following schedule provides a suggested specification which has been proven to exceed building regulations requirements for water conservation (Regulation 36 Compliance).

Detailed calculations will be carried out a later design stage to demonstrate how the target of 110 litres/person/day can be achieved.

Internal Potable Water Fixing	Flow Rate / Capacity
Toilet	Dual flush 6 and 4 litres
Basin Taps	6 litres / minute
Bath	180 litres (capacity to overflow)
Shower	8 litres / minute
Kitchen Taps	8 litres / minute

Table 7.1: Water consumption

8.0 SUMMARY

The proposed development has been well designed to cope with and mitigate against the effects of climate change. The energy strategy proposes the installation of efficient internal ASHP units to provide low carbon domestic hot water, with additional rooftop PV panels to further offset carbon dioxide emissions associated with the properties. The proximity of local amenities and public transport links should help to reduce car journeys associated with the development.

9.0 APPENDIX A – SAP CALCULATIONS

Full SAP Calculation Printout

Property Reference	Plot 4	**Issued on Date**	03/09/2024
Assessment Reference	Be Green	**Prop Type Ref**	
Property			

SAP Rating	77 C	**DER**	5.43	**TER**	11.71
Environmental	95 A	**% DER < TER**			53.63
CO_2 Emissions (t/year)	0.5	**DFEE**	40.82	**TFEE**	42.58
Compliance Check	See BREL	**% DFEE < TFEE**			4.12
% DPER < TPER	9.64	**DPER**	55.46	**TPER**	61.38

Assessor Details	Mr. Josh Childs	**Assessor ID**	W470-0001
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)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 117.2300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(5)

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2. Ventilation rate

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

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

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.3297	0.3255	0.3213	0.3000	0.2957	0.2745	0.2745	0.2702	0.2830	0.2957	0.3043	0.3127	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000	(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.6164			(33)

Party Wall Ground Floor	18.6000	0.0000	0.0000	70.0000	1302.0000	(32)
Party Wall Floor 1	43.7500	0.0000	0.0000	70.0000	3062.5000	(32)
Party Wall Floor 2	28.8600	0.0000	0.0000	70.0000	2020.2000	(32)
Internal Wall Ground Floor	20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1	46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2	19.0300			9.0000	171.2700	(32c)
Internal Floor 1	22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground	22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1	51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24990.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 213.1790 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	1.3500	0.1000	0.1350
E16 Corner (normal)	12.0000	0.1000	1.2000
E18 Party wall between dwellings	14.2000	0.0600	0.8520
E20 Exposed floor (normal)	12.3000	0.2000	2.4600
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1 Party wall - Ground floor	8.7500	0.0600	0.5250
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.2515 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 69.8679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2493	34.7950	34.3407	32.0691	31.6148	29.3432	29.3432	28.8889	30.2519	31.6148	32.5234	33.4321	(38)
Heat transfer coeff	105.1173	104.6629	104.2086	101.9371	101.4828	99.2112	99.2112	98.7569	100.1198	101.4828	102.3914	103.3000	(39)

Average = Sum(39)m / 12 = 101.8235

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8967	0.8928	0.8889	0.8695	0.8657	0.8463	0.8463	0.8424	0.8540	0.8657	0.8734	0.8812	(40)
HLP (average)												0.8686	
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 2.8519 (42)
Hot water usage for mixer showers

72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)

Energy content (annual) Total = Sum(45)m = 2244.0500
Distribution loss (46)m = 0.15 x (45)m

34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:
Store volume 269.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.7700 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.9558 (55)
Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)

If cylinder contains dedicated solar storage

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(57)
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)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

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

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS
Output from w/h

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)

Total per year (kWh/year) = Sum(64)m = 2592.9170 (64)
12Total per year (kWh/year) 2593 (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

77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.3912	158.7545	143.3912	148.1709	143.3912	148.1709	143.3912	143.3912	148.1709	143.3912	148.1709	143.3912	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	594.7610	610.3619	582.4654	560.2389	528.7320	507.6605	486.0014	486.7615	503.2206	522.1656	557.5943	580.8889	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.8000	0.7700	24.7170	(76)
West	4.6500	19.6403	0.5000	0.8000	0.7700	25.3159	(80)
West	9.5000	19.6403	0.5000	0.8000	0.7700	51.7207	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	109.0584	212.8859	352.9647	523.8291	653.4395	674.7892	639.9583	541.4380	412.9852	252.9157	135.8163	89.8375	(83)
Total gains	703.8194	823.2478	935.4301	1084.0679	1182.1715	1182.4496	1125.9598	1028.1995	916.2058	775.0813	693.4106	670.7264	(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	66.0399	66.3266	66.6157	68.1002	68.4051	69.9713	69.9713	70.2932	69.3363	68.4051	67.7981	67.2017	
alpha	5.4027	5.4218	5.4410	5.5400	5.5603	5.6648	5.6648	5.6862	5.6224	5.5603	5.5199	5.4801	
util living area													
	0.9957	0.9894	0.9706	0.8961	0.7387	0.5295	0.3866	0.4394	0.7092	0.9450	0.9902	0.9966	(86)
MIT	19.8484	20.0486	20.3404	20.7122	20.9225	20.9903	20.9986	20.9973	20.9547	20.6450	20.1916	19.8310	(87)
Th 2	20.1703	20.1736	20.1769	20.1935	20.1968	20.2134	20.2134	20.2167	20.2067	20.1968	20.1901	20.1835	(88)
util rest of house													
	0.9945	0.9865	0.9628	0.8714	0.6903	0.4675	0.3181	0.3658	0.6428	0.9261	0.9871	0.9957	(89)
MIT 2	19.1130	19.3142	19.6031	19.9665	20.1460	20.2088	20.2130	20.2158	20.1820	19.9153	19.4704	19.1063	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.3550	19.5558	19.8457	20.2119	20.4015	20.4659	20.4715	20.4729	20.4362	20.1553	19.7077	19.3447	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.6550	19.8558	20.1457	20.5119	20.7015	20.7659	20.7715	20.7729	20.7362	20.4553	20.0077	19.6447	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9852	0.9624	0.8817	0.7214	0.5113	0.3668	0.4183	0.6880	0.9329	0.9863	0.9950	(94)
Useful gains	699.3176	811.0754	900.2830	955.8639	852.8092	604.5781	412.9519	430.0479	630.3821	723.0457	683.8982	667.3466	(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													
	1614.0711	1565.3184	1421.9946	1183.6786	913.4943	611.7265	413.8558	431.8587	664.4170	1000.1470	1321.6334	1595.4385	(97)
Space heating kWh													
	680.5766	506.8513	388.1535	164.0266	45.1497	0.0000	0.0000	0.0000	0.0000	206.1634	459.1693	690.5004	(98a)
Space heating requirement - total per year (kWh/year)												3140.5908	
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													
	680.5766	506.8513	388.1535	164.0266	45.1497	0.0000	0.0000	0.0000	0.0000	206.1634	459.1693	690.5004	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3140.5908	
Space heating per m2											(98c) / (4) =	26.7900	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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													
	680.5766	506.8513	388.1535	164.0266	45.1497	0.0000	0.0000	0.0000	0.0000	206.1634	459.1693	690.5004	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	680.5766	506.8513	388.1535	164.0266	45.1497	0.0000	0.0000	0.0000	0.0000	206.1634	459.1693	690.5004	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month													
	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	29.7939	23.9017	21.5209	15.7671	12.1790	9.9503	11.1101	14.4413	18.7578	24.6112	27.7983	30.6219	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.0180	-43.4256	-67.5551	-79.2535	-86.4285	-80.1433	-79.2030	-72.3881	-60.9707	-50.3952	-31.8738	-23.7798	(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	3140.5908	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	240.4535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-703.4346	(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	4144.8715	(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	3140.5908	0.1563	490.7576	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			599.4953	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	240.4535	0.1443	34.7049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-703.4346	0.1338	-94.0902	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-94.0902	(269)
Total CO2, kg/year			636.8097	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			5.4300	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3140.5908	1.5785	4957.4390	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			6129.6601	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	240.4535	1.5338	368.8155	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-703.4346	1.4943	-1051.1555	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1051.1555	(283)
Total Primary energy kWh/year			6501.9299	(286)
Dwelling Primary energy Rate (DPER)			55.4600	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3175	(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	0.4048	0.3968	0.3889	0.3492	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3571	0.3730	(22b)
Effective ac	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(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	
TER Opening Type (Uw = 1.20)			18.6900	1.1450	21.4008			(27)
Roof Windows F2			1.2800	1.5038	1.9248			(27a)
Ground Floor			42.9000	0.1300	5.5770			(28a)
Exposed Floor Garage			20.1500	0.1300	2.6195			(28b)
Exposed Floor Overhang			8.2900	0.1300	1.0777			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1800	5.1192			(29a)
Garage Wall	18.6000		18.6000	0.1800	3.3480			(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1800	4.5072			(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1800	4.0464			(29a)
External Roof	47.3600	1.2800	46.0800	0.1100	5.0688			(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.6894			(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000			(32)
Party Wall Floor 1			43.7500	0.0000	0.0000			(32)
Party Wall Floor 2			28.8600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K: 213.1790 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0000	0.0000
E13 Gable (insulation at rafter level)	14.3200	0.0800	1.1456
E14 Flat roof	1.3500	0.0800	0.1080
E16 Corner (normal)	12.0000	0.0900	1.0800
E18 Party wall between dwellings	14.2000	0.0600	0.8520
E20 Exposed floor (normal)	12.3000	0.3200	3.9360
E21 Exposed floor (inverted)	6.2000	0.3200	1.9840
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1 Party wall - Ground floor	8.7500	0.0800	0.7000
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1200	0.3120
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2400	2.7120
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	3.2000	0.0800	0.2560
R4 Ridge (vaulted ceiling)	7.4000	0.0800	0.5920

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	18.7351	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	73.4245	(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	62.2051	61.8651	61.5318	59.9663	59.6734	58.3100	58.3100	58.0575	58.8351	59.6734	60.2660	60.8854	(38)
Heat transfer coeff	135.6296	135.2896	134.9563	133.3908	133.0979	131.7344	131.7344	131.4819	132.2596	133.0979	133.6904	134.3099	(39)
Average = Sum(39)m / 12 =												133.3894	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1541	1.1512	1.1379	1.1354	1.1237	1.1237	1.1216	1.1282	1.1354	1.1404	1.1457	(40)
HLP (average)												1.1378	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy: 2.8519 (42)

Hot water usage for mixer showers	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616 (42a)
Hot water usage for baths	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966 (42b)

Hot water usage for other uses

	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368 (42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:

Store volume	150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7527	(55)

Total storage loss

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)

Total heat required for water heating calculated for each month

	279.3691	246.9084	261.7934	228.8100	220.9055	198.0688	194.7002	202.9386	205.7396	230.6113	246.6953	276.1271 (62)
WWHRS	-32.9326	-29.1258	-30.4989	-25.2543	-23.5361	-20.1400	-18.8780	-20.0749	-20.8376	-24.5653	-27.8295	-32.3227 (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

	246.4365	217.7826	231.2945	203.5557	197.3694	177.9288	175.8222	182.8637	184.9020	206.0461	218.8658	243.8044 (64)
										Total per year (kWh/year) = Sum(64)m =		2486.6718 (64)
12Total per year (kWh/year)												2487 (64)

Electric shower(s)

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

Heat gains from water heating, kWh/month

	114.6733	101.7721	108.8294	97.1598	95.2342	86.9383	86.5209	89.2602	89.4888	98.4614	103.1066	113.5954 (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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	154.1308	151.4466	146.2761	134.9441	128.0029	120.7477	116.2916	119.9734	124.2901	132.3406	143.2036	152.6820	(72)
Total internal gains	650.5486	666.4372	638.2530	616.1160	584.5196	560.5376	538.7891	539.5491	556.0977	577.9532	613.4714	636.6765	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(76)
West	14.1500	19.6403	0.6300	0.7000	0.7700	84.9328	(80)
North	1.2800	16.1759	0.6300	0.7000	1.0000	8.2179	(82)

Solar gains	120.4012	235.0179	389.7096	578.5506	721.9363	745.6425	707.1050	598.0814	456.0301	279.2158	149.9386	99.1844	(83)
Total gains	770.9499	901.4552	1027.9626	1194.6666	1306.4559	1306.1801	1245.8941	1137.6306	1012.1278	857.1691	763.4101	735.8610	(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	51.1830	51.3117	51.4384	52.0421	52.1566	52.6964	52.6964	52.7976	52.4872	52.1566	51.9254	51.6860	
alpha	4.4122	4.4208	4.4292	4.4695	4.4771	4.5131	4.5131	4.5198	4.4991	4.4771	4.4617	4.4457	
util living area	0.9943	0.9880	0.9717	0.9161	0.7947	0.6106	0.4572	0.5169	0.7734	0.9520	0.9888	0.9954	(86)
MIT	19.4514	19.6687	20.0088	20.4609	20.7928	20.9526	20.9896	20.9825	20.8651	20.4102	19.8558	19.4214	(87)
Th 2	19.9546	19.9569	19.9592	19.9700	19.9721	19.9815	19.9815	19.9833	19.9779	19.9721	19.9680	19.9637	(88)
util rest of house	0.9927	0.9846	0.9635	0.8921	0.7414	0.5264	0.3553	0.4096	0.6971	0.9331	0.9850	0.9940	(89)
MIT 2	18.1539	18.4318	18.8626	19.4230	19.7958	19.9531	19.9778	19.9763	19.8820	19.3759	18.6794	18.1218	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	18.5808	18.8387	19.2397	19.7645	20.1238	20.2819	20.3107	20.3074	20.2055	19.7162	19.0665	18.5494	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5808	18.8387	19.2397	19.7645	20.1238	20.2819	20.3107	20.3074	20.2055	19.7162	19.0665	18.5494	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9796	0.9561	0.8864	0.7500	0.5523	0.3888	0.4447	0.7157	0.9272	0.9804	0.9914	(94)
Useful gains	762.9268	883.1085	982.8398	1058.9924	979.8564	721.3476	484.4480	505.9010	724.4164	794.7696	748.4399	729.5332	(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													

	1936.8975	1885.7643	1719.3041	1449.2197	1121.1954	748.5073	488.8286	513.7499	807.5065	1213.3451	1599.8018	1927.2655	(97)
Space heating kWh													
	873.4342	673.7847	547.9295	280.9636	105.1562	0.0000	0.0000	0.0000	0.0000	311.4201	612.9805	891.1128	(98a)
Space heating requirement - total per year (kWh/year)												4296.7817	
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													
	873.4342	673.7847	547.9295	280.9636	105.1562	0.0000	0.0000	0.0000	0.0000	311.4201	612.9805	891.1128	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4296.7817	
Space heating per m2											(98c) / (4) =	36.6526	(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													
	873.4342	673.7847	547.9295	280.9636	105.1562	0.0000	0.0000	0.0000	0.0000	311.4201	612.9805	891.1128	(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)													
	946.2993	729.9943	593.6397	304.4027	113.9287	0.0000	0.0000	0.0000	0.0000	337.3999	664.1176	965.4527	(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													
	246.4365	217.7826	231.2945	203.5557	197.3694	177.9288	175.8222	182.8637	184.9020	206.0461	218.8658	243.8044	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.6495	86.4192	85.9236	84.7828	82.7139	79.8000	79.8000	79.8000	79.8000	84.9836	86.2409	86.6994	(217)
Fuel for water heating, kWh/month													
	284.4062	252.0071	269.1864	240.0908	238.6168	222.9684	220.3286	229.1526	231.7067	242.4540	253.7842	281.2064	(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	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.4483	-59.1238	-85.9577	-97.7567	-106.3027	-99.4795	-98.1926	-92.2329	-81.9066	-68.0510	-45.7893	-35.7493	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.3658	-45.1680	-90.2065	-136.1354	-180.6702	-181.8300	-179.7517	-151.9445	-110.9969	-64.8823	-28.6146	-16.8839	(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												4655.2348	(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												2965.9082	(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)												244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2120.4400	(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												5831.6599	(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	4655.2348	0.2100	977.5993	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2965.9082	0.2100	622.8407	(264)
Space and water heating			1600.4400	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-911.9903	0.1344	-122.5344	
PV Unit electricity exported	-1208.4497	0.1257	-151.9583	
Total			-274.4927	(269)
Total CO2, kg/year			1373.2314	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.7100	(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	4655.2348	1.1300	5260.4153	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2965.9082	1.1300	3351.4763	(278)
Space and water heating			8611.8916	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	244.9569	1.5338	375.7231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-911.9903	1.4966	-1364.8454	
PV Unit electricity exported	-1208.4497	0.4616	-557.7821	
Total			-1922.6274	(283)
Total Primary energy kWh/year			7195.0880	(286)
Target Primary Energy Rate (TPER)			61.3800	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b) x	3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c) x	2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d) x	2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3235	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2750	(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	0.3506	0.3437	0.3368	0.3025	0.2956	0.2612	0.2612	0.2543	0.2750	0.2956	0.3093	0.3231	(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 0.5615 0.5591 0.5567 0.5457 0.5437 0.5341 0.5341 0.5323 0.5378 0.5437 0.5478 0.5522	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000	(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6164			(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000	70.0000	1302.0000	(32)
Party Wall Floor 1			43.7500	0.0000	0.0000	70.0000	3062.5000	(32)
Party Wall Floor 2			28.8600	0.0000	0.0000	70.0000	2020.2000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	24990.9700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 213.1790 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	13.9500	0.1600	2.2320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13	Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14	Flat roof	1.3500	0.1000	0.1350
E16	Corner (normal)	12.0000	0.1000	1.2000
E18	Party wall between dwellings	14.2000	0.0600	0.8520
E20	Exposed floor (normal)	12.3000	0.2000	2.4600
E21	Exposed floor (inverted)	6.2000	0.2000	1.2400
E25	Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1	Party wall - Ground floor	8.7500	0.0600	0.5250
P2	Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900
P8	Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600
R1	Head of roof window	1.6000	0.1000	0.1600
R2	Sill of roof window	1.6000	0.0800	0.1280
R3	Jamb of roof window	3.2000	0.1000	0.3200
R4	Ridge (vaulted ceiling)	7.4000	0.1000	0.7400

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.2515 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 69.8679 (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	60.0175	59.7624	59.5124	58.3380	58.1183	57.0954	57.0954	56.9060	57.4894	58.1183	58.5628	59.0275	(38)
Heat transfer coeff	129.8855	129.6304	129.3803	128.2060	127.9862	126.9634	126.9634	126.7740	127.3574	127.9862	128.4307	128.8954	(39)

Average = Sum(39)m / 12 = 128.2049

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1080	1.1058	1.1036	1.0936	1.0918	1.0830	1.0830	1.0814	1.0864	1.0918	1.0955	1.0995	(40)
HLP (average)												1.0936	
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 2.8519 (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

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 68.6878 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.9385	72.8825	70.6380	67.8446	65.3525	62.7627	62.2248	64.4648	66.7621	69.4217	72.2398	74.8334	(44)
Energy conte	118.6843	103.7838	108.5680	92.8759	87.9770	77.1740	75.2555	79.8208	82.3243	94.2046	102.9188	117.1710	(45)

Energy content (annual) Total = Sum(45)m = 1140.7580

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

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

Water storage loss:

Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(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

100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(64)

Total per year (kWh/year) = Sum(64)m = 969.6443 (64)

12Total per year (kWh/year) 970 (64)

Electric shower(s)

57.6901	51.4023	56.1294	53.5636	54.5687	52.0532	53.7883	54.5687	53.5636	56.1294	55.0739	57.6901	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 656.2213 (64a)

Heat gains from water heating, kWh/month

39.6429	34.9046	37.1030	33.1270	32.3373	29.4128	29.4389	30.6041	30.8848	34.0508	35.6387	39.3213	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	143.3912	158.7545	143.3912	148.1709	143.3912	148.1709	143.3912	143.3912	148.1709	143.3912	148.1709	143.3912	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	53.2835	51.9414	49.8697	46.0098	43.4641	40.8511	39.5684	41.1345	42.8956	45.7672	49.4982	52.8513	(72)
Total internal gains	544.0158	560.9587	536.1610	521.4065	494.2952	477.8660	459.3803	458.0247	471.9281	485.6943	513.9910	531.1603	(73)

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6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					4.5400	19.6403	0.5000	0.8000	0.7700		24.7170	(76)
West					4.6500	19.6403	0.5000	0.8000	0.7700		25.3159	(80)
West					9.5000	19.6403	0.5000	0.8000	0.7700		51.7207	(80)
North					1.2800	16.1759	0.5600	0.7000	1.0000		7.3048	(82)
Solar gains	109.0584	212.8859	352.9647	523.8291	653.4395	674.7892	639.9583	541.4380	412.9852	252.9157	135.8163	89.8375 (83)
Total gains	653.0741	773.8446	889.1257	1045.2356	1147.7347	1152.6551	1099.3386	999.4627	884.9134	738.6100	649.8073	620.9978 (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	53.4466	53.5518	53.6553	54.1467	54.2397	54.6767	54.6767	54.7584	54.5075	54.2397	54.0520	53.8571	
alpha	4.5631	4.5701	4.5770	4.6098	4.6160	4.6451	4.6451	4.6506	4.6338	4.6160	4.6035	4.5905	
util living area	0.9971	0.9932	0.9825	0.9407	0.8366	0.6573	0.4971	0.5626	0.8196	0.9695	0.9939	0.9977	(86)
MIT	19.4153	19.6230	19.9525	20.4052	20.7589	20.9424	20.9873	20.9781	20.8391	20.3558	19.8075	19.3833	(87)
Th 2	19.9943	19.9961	19.9979	20.0060	20.0076	20.0147	20.0147	20.0160	20.0120	20.0076	20.0045	20.0012	(88)
util rest of house	0.9962	0.9912	0.9771	0.9223	0.7891	0.5734	0.3912	0.4520	0.7504	0.9567	0.9918	0.9970	(89)
MIT 2	18.5455	18.7534	19.0809	19.5246	19.8426	19.9868	20.0110	20.0090	19.9187	19.4865	18.9444	18.5187	(90)
Living area fraction									fLA = Living area / (4) =			0.3290	(91)
MIT	18.8317	19.0395	19.3677	19.8143	20.1441	20.3012	20.3322	20.3279	20.2215	19.7725	19.2283	18.8032	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8317	19.0395	19.3677	19.8143	20.1441	20.3012	20.3322	20.3279	20.2215	19.7725	19.2283	18.8032	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9887	0.9728	0.9181	0.7964	0.5990	0.4261	0.4882	0.7668	0.9528	0.9895	0.9959	(94)
Useful gains	649.6972	765.0834	864.9250	959.6548	914.0028	690.4059	468.4030	487.9722	678.5277	703.7660	642.9885	618.4312	(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	1887.4520	1832.9075	1664.8227	1399.2804	1080.7241	723.8455	473.8580	497.9514	779.6203	1173.9601	1557.6510	1882.2859	(97)
Space heating kWh	920.8896	717.5778	595.1239	316.5305	124.0407	0.0000	0.0000	0.0000	0.0000	349.8244	658.5570	940.3079	(98a)
Space heating requirement - total per year (kWh/year)												4622.8517	
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	920.8896	717.5778	595.1239	316.5305	124.0407	0.0000	0.0000	0.0000	0.0000	349.8244	658.5570	940.3079	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4622.8517	
Space heating per m2											(98c) / (4) =	39.4340	(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	1193.4558	939.5291	963.4822	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8487	0.9105	0.8744	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1012.9245	855.4530	842.4623	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1274.3850	1215.8832	1105.0382	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	188.2516	268.1601	195.3565	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	47.0629	67.0400	48.8391	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												162.9420	(107)
Energy for space heating												39.4340	(99)
Energy for space cooling												1.3899	(108)
Total												40.8240	(109)
Fabric Energy Efficiency (DFEE)												40.8	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3735	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3175	(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	0.4048	0.3968	0.3889	0.3492	0.3413	0.3016	0.3016	0.2937	0.3175	0.3413	0.3571	0.3730	(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	0.5819	0.5787	0.5756	0.5610	0.5582	0.5455	0.5455	0.5431	0.5504	0.5582	0.5638	0.5696	(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	
TER Opening Type (Uw = 1.20)			18.6900	1.1450	21.4008			(27)
Roof Windows F2			1.2800	1.5038	1.9248			(27a)
Ground Floor			42.9000	0.1300	5.5770			(28a)
Exposed Floor Garage			20.1500	0.1300	2.6195			(28b)
Exposed Floor Overhang			8.2900	0.1300	1.0777			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1800	5.1192			(29a)
Garage Wall	18.6000		18.6000	0.1800	3.3480			(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1800	4.5072			(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1800	4.0464			(29a)
External Roof	47.3600	1.2800	46.0800	0.1100	5.0688			(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		54.6894			(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000			(32)
Party Wall Floor 1			43.7500	0.0000	0.0000			(32)
Party Wall Floor 2			28.8600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 213.1790 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	13.9500	0.1600	2.2320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0000	0.0000
E13	Gable (insulation at rafter level)	14.3200	0.0800	1.1456
E14	Flat roof	1.3500	0.0800	0.1080
E16	Corner (normal)	12.0000	0.0900	1.0800
E18	Party wall between dwellings	14.2000	0.0600	0.8520
E20	Exposed floor (normal)	12.3000	0.3200	3.9360
E21	Exposed floor (inverted)	6.2000	0.3200	1.9840
E25	Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1	Party wall - Ground floor	8.7500	0.0800	0.7000
P2	Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	2.6000	0.1200	0.3120
P8	Party Wall - Exposed floor (inverted)	11.3000	0.2400	2.7120
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	3.2000	0.0800	0.2560
R4	Ridge (vaulted ceiling)	7.4000	0.0800	0.5920

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		18.7351	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	73.4245	(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	62.2051	61.8651	61.5318	59.9663	59.6734	58.3100	58.3100	58.0575	58.8351	59.6734	60.2660	60.8854	(38)
Heat transfer coeff	135.6296	135.2896	134.9563	133.3908	133.0979	131.7344	131.7344	131.4819	132.2596	133.0979	133.6904	134.3099	(39)
Average = Sum(39)m / 12 =												133.3894	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1570	1.1541	1.1512	1.1379	1.1354	1.1237	1.1237	1.1216	1.1282	1.1354	1.1404	1.1457	(40)
HLP (average)												1.1378	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8519 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths													

	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)
Hot water usage for other uses													
	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)
Average daily hot water use (litres/day)												68.6878	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	74.9385	72.8825	70.6380	67.8446	65.3525	62.7627	62.2248	64.4648	66.7621	69.4217	72.2398	74.8334	(44)
Energy conte	118.6843	103.7838	108.5680	92.8759	87.9770	77.1740	75.2555	79.8208	82.3243	94.2046	102.9188	117.1710	(45)
Energy content (annual)										Total = Sum(45)m =		1140.7580	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(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													
	100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(64)
										Total per year (kWh/year) = Sum(64)m =		969.6443	(64)
12Total per year (kWh/year)												970	(64)
Electric shower(s)													
	57.6901	51.4023	56.1294	53.5636	54.5687	52.0532	53.7883	54.5687	53.5636	56.1294	55.0739	57.6901	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												656.2213	(64a)
Heat gains from water heating, kWh/month													
	39.6429	34.9046	37.1030	33.1270	32.3373	29.4128	29.4389	30.6041	30.8848	34.0508	35.6387	39.3213	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	53.2835	51.9414	49.8697	46.0098	43.4641	40.8511	39.5684	41.1345	42.8956	45.7672	49.4982	52.8513	(72)
Total internal gains													
	546.7013	563.9320	538.8466	524.1816	496.9808	480.6410	462.0658	460.7103	474.7032	488.3799	516.7660	533.8458	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(76)
West	14.1500	19.6403	0.6300	0.7000	0.7700	84.9328	(80)
North	1.2800	16.1759	0.6300	0.7000	1.0000	8.2179	(82)

Solar gains	120.4012	235.0179	389.7096	578.5506	721.9363	745.6425	707.1050	598.0814	456.0301	279.2158	149.9386	99.1844	(83)
Total gains	667.1026	798.9500	928.5561	1102.7323	1218.9171	1226.2835	1169.1709	1058.7917	930.7333	767.5957	666.7047	633.0303	(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	51.1830	51.3117	51.4384	52.0421	52.1566	52.6964	52.6964	52.7976	52.4872	52.1566	51.9254	51.6860	
alpha	4.4122	4.4208	4.4292	4.4695	4.4771	4.5131	4.5131	4.5198	4.4991	4.4771	4.4617	4.4457	
util living area													
	0.9968	0.9925	0.9803	0.9341	0.8237	0.6422	0.4850	0.5508	0.8100	0.9669	0.9934	0.9975	(86)
MIT	19.3464	19.5676	19.9171	20.3941	20.7573	20.9421	20.9869	20.9775	20.8350	20.3335	19.7598	19.3168	(87)
Th 2	19.9546	19.9569	19.9592	19.9700	19.9721	19.9815	19.9815	19.9833	19.9779	19.9721	19.9680	19.9637	(88)
util rest of house													
	0.9958	0.9902	0.9743	0.9139	0.7736	0.5565	0.3780	0.4385	0.7378	0.9530	0.9910	0.9967	(89)
MIT 2	18.4469	18.6686	19.0159	19.4836	19.8080	19.9539	19.9778	19.9762	19.8836	19.4365	18.8692	18.4242	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	18.7429	18.9644	19.3124	19.7832	20.1203	20.2790	20.3098	20.3056	20.1966	19.7316	19.1622	18.7178	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7429	18.9644	19.3124	19.7832	20.1203	20.2790	20.3098	20.3056	20.1966	19.7316	19.1622	18.7178	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9874	0.9695	0.9096	0.7815	0.5827	0.4132	0.4753	0.7551	0.9488	0.9885	0.9954	(94)
Useful gains	663.2958	788.8588	900.2078	1002.9943	952.6109	714.5655	483.1139	503.2836	702.7711	728.2890	659.0439	630.1477	(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													
	1958.8816	1902.7650	1729.1177	1451.7133	1120.7229	748.1262	488.7095	513.5178	806.3383	1215.4033	1612.6016	1949.8910	(97)
Space heating kWh													
	963.9158	748.5450	616.7090	323.0777	125.0754	0.0000	0.0000	0.0000	0.0000	362.4130	686.5616	981.8890	(98a)

Space heating requirement - total per year (kWh/year) 4808.1865
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
963.9158 748.5450 616.7090 323.0777 125.0754 0.0000 0.0000 0.0000 362.4130 686.5616 981.8890 (98c)
Space heating requirement after solar contribution - total per year (kWh/year) 4808.1865
Space heating per m2 (98c) / (4) = 41.0150 (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	1238.3036	974.8348	999.2627	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8537	0.9129	0.8771	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1057.0898	889.9195	876.4450	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1355.8529	1293.1655	1170.4999	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	215.1094	300.0150	218.7769	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	53.7773	75.0038	54.6942	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 183.4753 (107)
Energy for space heating 41.0150 (99)
Energy for space cooling 1.5651 (108)
Total 42.5801 (109)
Fabric Energy Efficiency (TFEE) 42.6 (109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)

Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 117.2300 (4)
Dwelling volume (3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 323.9305 (5)

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2. Ventilation rate

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

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

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

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.4000 (23c)

Effective ac 0.3297 0.3255 0.3213 0.3000 0.2957 0.2745 0.2745 0.2702 0.2830 0.2957 0.3043 0.3127 (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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)

Roof Windows F2			1.2800	1.2357	1.5817		(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000 (28a)
Exposed Floor Garage			20.1500	0.1126	2.2683		(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948		(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000 (29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000 (29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000 (29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000 (29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200 (30)
Total net area of external elements Aum(A, m2)			231.9500				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6164		(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000	70.0000	1302.0000 (32)
Party Wall Floor 1			43.7500	0.0000	0.0000	70.0000	3062.5000 (32)
Party Wall Floor 2			28.8600	0.0000	0.0000	70.0000	2020.2000 (32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500 (32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700 (32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700 (32c)
Internal Floor 1			22.7500			18.0000	409.5000 (32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500 (32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	24990.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		213.1790 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	1.3500	0.1000	0.1350
E16 Corner (normal)	12.0000	0.1000	1.2000
E18 Party wall between dwellings	14.2000	0.0600	0.8520
E20 Exposed floor (normal)	12.3000	0.2000	2.4600
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1 Party wall - Ground floor	8.7500	0.0600	0.5250
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		17.2515 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	69.8679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2493	34.7950	34.3407	32.0691	31.6148	29.3432	29.3432	28.8889	30.2519	31.6148	32.5234	33.4321	(38)
Heat transfer coeff	105.1173	104.6629	104.2086	101.9371	101.4828	99.2112	99.2112	98.7569	100.1198	101.4828	102.3914	103.3000	(39)
Average = Sum(39)m / 12 =												101.8235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8967	0.8928	0.8889	0.8695	0.8657	0.8463	0.8463	0.8424	0.8540	0.8657	0.8734	0.8812	(40)
HLP (average)												0.8686	
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		2.8519 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day)		135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	

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

34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:		
Store volume		269.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.7700 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.9558 (55)

Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)

If cylinder contains dedicated solar storage

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
									Total per year (kWh/year) = Sum(64)m =		2592.9170	(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

77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.0387	30.2328	24.5870	18.6139	13.9141	11.7469	12.6929	16.4988	22.1446	28.1177	32.8175	34.9847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	670.3116	668.1824	646.3770	605.6775	564.5053	527.3276	505.2754	508.4022	529.3538	566.7718	611.8659	651.2666	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.8000	0.7700	24.7170	(76)
West	4.6500	19.6403	0.5000	0.8000	0.7700	25.3159	(80)
West	9.5000	19.6403	0.5000	0.8000	0.7700	51.7207	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	109.0584	212.8859	352.9647	523.8291	653.4395	674.7892	639.9583	541.4380	412.9852	252.9157	135.8163	89.8375	(83)
Total gains	779.3700	881.0682	999.3417	1129.5066	1217.9448	1202.1167	1145.2337	1049.8402	942.3390	819.6874	747.6822	741.1041	(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	66.0399	66.3266	66.6157	68.1002	68.4051	69.9713	69.9713	70.2932	69.3363	68.4051	67.7981	67.2017	
alpha	5.4027	5.4218	5.4410	5.5400	5.5603	5.6648	5.6648	5.6862	5.6224	5.5603	5.5199	5.4801	
util living area													
	0.9930	0.9856	0.9616	0.8818	0.7229	0.5214	0.3802	0.4306	0.6939	0.9323	0.9862	0.9946	(86)
MIT	19.9283	20.1075	20.3984	20.7392	20.9304	20.9910	20.9987	20.9976	20.9593	20.6799	20.2473	19.9062	(87)
Th 2	20.1703	20.1736	20.1769	20.1935	20.1968	20.2134	20.2134	20.2167	20.2067	20.1968	20.1901	20.1835	(88)
util rest of house													
	0.9912	0.9818	0.9518	0.8550	0.6742	0.4601	0.3127	0.3584	0.6276	0.9103	0.9820	0.9931	(89)
MIT 2	19.1922	19.3720	19.6584	19.9898	20.1515	20.2091	20.2130	20.2159	20.1847	19.9464	19.5249	19.1809	(90)
Living area fraction									fLA = Living area / (4) =			0.3290	(91)
MIT	19.4344	19.6140	19.9018	20.2363	20.4078	20.4664	20.4715	20.4731	20.4396	20.1878	19.7626	19.4195	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.7344	19.9140	20.2018	20.5363	20.7078	20.7664	20.7715	20.7731	20.7396	20.4878	20.0626	19.7195	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9805	0.9521	0.8670	0.7058	0.5034	0.3607	0.4098	0.6730	0.9191	0.9812	0.9921	(94)
Useful gains	771.5877	863.8453	951.5051	979.3266	859.5839	605.1542	413.0328	430.2410	634.1919	753.3373	733.6044	735.2564	(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													
	1622.4218	1571.4072	1427.8508	1186.1731	914.1321	611.7733	413.8618	431.8732	664.7513	1003.4364	1327.2576	1603.1687	(97)
Space heating kWh													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98a)
Space heating requirement - total per year (kWh/year)												2911.6474	
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													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2911.6474	
Space heating per m2											(98c) / (4) =	24.8371	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(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)

Space heating fuel used, main system 2 0.0000 (213)

Water heating
Water heating requirement

	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620 (64)
Efficiency of water heater												336.6824 (216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824 (217)
Fuel for water heating, kWh/month												
	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752 (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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078 (231)
Lighting	29.7939	23.9017	21.5209	15.7671	12.1790	9.9503	11.1101	14.4413	18.7578	24.6112	27.7983	30.6219 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-27.9196	-43.2471	-67.1004	-78.7733	-86.1716	-80.1433	-79.2030	-72.3881	-60.9707	-50.1124	-31.7517	-23.7078 (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 2911.6474 (211)
Space heating fuel - main system 2 0.0000 (213)
Space heating fuel - secondary 0.0000 (215)
Efficiency of water heater 336.6824
Water heating fuel used 770.1375 (219)
Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)
mechanical ventilation fans (SFP = 1.7640) 697.1244 (230a)
Total electricity for the above, kWh/year 697.1244 (231)
Electricity for lighting (calculated in Appendix L) 240.4535 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV generation -701.4891 (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 3917.8736 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2911.6474	16.4900	480.1307	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	16.4900	126.9957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	16.4900	114.9558	(249)
Energy for lighting	240.4535	16.4900	39.6508	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-701.4891	16.4900	-115.6755	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-115.6755	(252)
Total energy cost			646.0574	(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] = 1.4336 (257)
SAP value 76.7606
SAP rating (Section 12) 77 (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	2911.6474	0.1564	455.2382	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			563.9759	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	240.4535	0.1443	34.7049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-701.4891	0.1337	-93.8048	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-93.8048	(269)
Total CO2, kg/year			601.5757	(272)
CO2 emissions per m2			5.1300	(273)
EI value			95.0311	
EI rating			95	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(5)

2. Ventilation rate

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.2167	0.1998	0.1955	0.1827	0.1827	0.1700	0.1700	0.1658	0.1700	0.1913	0.1870	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.3297	0.3127	0.3085	0.2957	0.2957	0.2830	0.2830	0.2787	0.2830	0.3043	0.3000	0.3127	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000	(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.6164			(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000	70.0000	1302.0000	(32)
Party Wall Floor 1			43.7500	0.0000	0.0000	70.0000	3062.5000	(32)
Party Wall Floor 2			28.8600	0.0000	0.0000	70.0000	2020.2000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	24990.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		213.1790 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	1.3500	0.1000	0.1350
E16 Corner (normal)	12.0000	0.1000	1.2000
E18 Party wall between dwellings	14.2000	0.0600	0.8520

E20 Exposed floor (normal)	12.3000	0.2000	2.4600	
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400	
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200	
P1 Party wall - Ground floor	8.7500	0.0600	0.5250	
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900	
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600	
R1 Head of roof window	1.6000	0.1000	0.1600	
R2 Sill of roof window	1.6000	0.0800	0.1280	
R3 Jamb of roof window	3.2000	0.1000	0.3200	
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 17.2515 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 69.8679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2493	33.4321	32.9777	31.6148	31.6148	30.2519	30.2519	29.7976	30.2519	32.5234	32.0691	33.4321	(38)
Heat transfer coeff	105.1173	103.3000	102.8457	101.4828	101.4828	100.1198	100.1198	99.6655	100.1198	102.3914	101.9371	103.3000	(39)

Average = Sum(39)m / 12 = 101.8235

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8967	0.8812	0.8773	0.8657	0.8657	0.8540	0.8540	0.8502	0.8540	0.8734	0.8695	0.8812	(40)
HLP (average)												0.8686	
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 2.8519 (42)

Hot water usage for mixer showers

72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2592.9170	(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	77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.0387	30.2328	24.5870	18.6139	13.9141	11.7469	12.6929	16.4988	22.1446	28.1177	32.8175	34.9847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains	670.3116	668.1824	646.3770	605.6775	564.5053	527.3276	505.2754	508.4022	529.3538	566.7718	611.8659	651.2666	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	25.9136	0.5000	0.8000	0.7700	32.6120	(76)
West	4.6500	25.9136	0.5000	0.8000	0.7700	33.4022	(80)
West	9.5000	25.9136	0.5000	0.8000	0.7700	68.2410	(80)
North	1.2800	20.9127	0.5600	0.7000	1.0000	9.4438	(82)

Solar gains	143.6990	239.9896	395.3941	595.5073	707.3994	789.4926	731.2543	633.4421	489.9491	301.5343	177.4026	112.9681	(83)
Total gains	814.0106	908.1720	1041.7711	1201.1848	1271.9047	1316.8202	1236.5296	1141.8443	1019.3029	868.3061	789.2684	764.2348	(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	66.0399	67.2017	67.4986	68.4051	68.4051	69.3363	69.3363	69.6523	69.3363	67.7981	68.1002	67.2017	
alpha	5.4027	5.4801	5.4999	5.5603	5.5603	5.6224	5.6224	5.6435	5.6224	5.5199	5.5400	5.4801	
util living area	0.9884	0.9790	0.9424	0.8312	0.6445	0.4238	0.2993	0.3226	0.5766	0.8789	0.9729	0.9908	(86)
MIT	20.0880	20.2425	20.5315	20.8258	20.9640	20.9971	20.9997	20.9995	20.9857	20.8037	20.4326	20.0754	(87)
Th 2	20.1703	20.1835	20.1868	20.1968	20.1968	20.2067	20.2067	20.2101	20.2067	20.1901	20.1935	20.1835	(88)
util rest of house	0.9852	0.9735	0.9280	0.7971	0.5908	0.3647	0.2353	0.2539	0.5056	0.8421	0.9643	0.9883	(89)
MIT 2	19.3507	19.5129	19.7937	20.0671	20.1753	20.2056	20.2067	20.2100	20.2002	20.0498	19.7090	19.3492	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.5933	19.7530	20.0364	20.3167	20.4348	20.4660	20.4676	20.4697	20.4586	20.2978	19.9471	19.5881	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.8933	20.0530	20.3364	20.6167	20.7348	20.7660	20.7676	20.7697	20.7586	20.5978	20.2471	19.8881	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9840	0.9724	0.9309	0.8156	0.6272	0.4064	0.2806	0.3026	0.5554	0.8617	0.9650	0.9871	(94)
Useful gains	800.9491	883.1483	969.8129	979.6611	797.7158	535.1776	346.9752	345.5282	566.1421	748.2583	761.6446	754.4063	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1523.4920	1482.6612	1340.7393	1118.0052	825.5437	537.2407	347.1729	345.8130	576.5518	900.8217	1207.6568	1486.2908	(97)
Space heating kWh	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98a)
Space heating requirement - total per year (kWh/year)												2315.8835	
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	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2315.8835	
Space heating per m2											(98c) / (4) =	19.7550	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	29.7939	23.9017	21.5209	15.7671	12.1790	9.9503	11.1101	14.4413	18.7578	24.6112	27.7983	30.6219	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.9700	-46.7454	-71.3543	-83.9436	-89.1447	-88.3476	-85.9587	-79.9070	-68.1852	-55.6300	-38.9299	-28.5329	(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												2315.8835	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												336.6824	
Water heating fuel used												770.1375	(219)

Space cooling fuel		0.0000 (221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)		697.1244 (230a)
Total electricity for the above, kWh/year		697.1244 (231)
Electricity for lighting (calculated in Appendix L)		240.4535 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation		-771.6494 (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		3251.9494 (238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2315.8835	26.0600	603.5192	(240)
Space heating - main system 2	0.0000	26.0600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	26.0600	200.6978	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	26.0600	181.6706	(249)
Energy for lighting	240.4535	26.0600	62.6622	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	26.0600	-201.0918	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-201.0918	(252)
Total energy cost			847.4580	(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	2315.8835	0.1572	363.9685	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			472.7062	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	240.4535	0.1443	34.7049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	0.1340	-103.3739	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-103.3739	(269)
Total CO2, kg/year			500.7369	(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	2315.8835	1.5818	3663.3195	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			4835.5407	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	240.4535	1.5338	368.8155	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	1.4951	-1153.6696	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1153.6696	(283)
Total Primary energy kWh/year			5105.2963	(286)

SAP 10 EPC IMPROVEMENTS

Be Green

Current energy efficiency rating:	C 77
Current environmental impact rating:	A 95

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.6	-£ 35	-16 kg (3.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
(none)			

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: C 77
Potential environmental impact rating: A 95

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)
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	£1049	£1049	£0
Space heating	£785	£785	£0
Water heating	£201	£201	£0
Lighting	£63	£63	£0
Generated (PV)	-£201	-£201	£0
Total cost of fuels	£848	£848	£0
Total cost of uses	£848	£848	£0
Delivered energy	28 kWh/m²	28 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.5 tonnes	0.0 tonnes
CO2 emissions per m²	4 kg/m²	4 kg/m²	0 kg/m²
Primary energy	44 kWh/m²	44 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(5)

2. Ventilation rate

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

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

Balanced mechanical ventilation with heat recovery
If mechanical ventilation 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.4000 (23c)

Effective ac	0.3297	0.3255	0.3213	0.3000	0.2957	0.2745	0.2745	0.2702	0.2830	0.2957	0.3043	0.3127	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000	(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)

Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	52.6164			(33)
Party Wall Ground Floor	18.6000	0.0000	0.0000	70.0000	1302.0000 (32)
Party Wall Floor 1	43.7500	0.0000	0.0000	70.0000	3062.5000 (32)
Party Wall Floor 2	28.8600	0.0000	0.0000	70.0000	2020.2000 (32)
Internal Wall Ground Floor	20.2500			9.0000	182.2500 (32c)
Internal Wall Floor 1	46.6300			9.0000	419.6700 (32c)
Internal Wall Floor 2	19.0300			9.0000	171.2700 (32c)
Internal Floor 1	22.7500			18.0000	409.5000 (32d)
Internal Ceiling Ground	22.7500			9.0000	204.7500 (32e)
Internal Ceiling Floor 1	51.1900			9.0000	460.7100 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	24990.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		213.1790 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	1.3500	0.1000	0.1350
E16 Corner (normal)	12.0000	0.1000	1.2000
E18 Party wall between dwellings	14.2000	0.0600	0.8520
E20 Exposed floor (normal)	12.3000	0.2000	2.4600
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1 Party wall - Ground floor	8.7500	0.0600	0.5250
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		17.2515 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	69.8679 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2493	34.7950	34.3407	32.0691	31.6148	29.3432	29.3432	28.8889	30.2519	31.6148	32.5234	33.4321	(38)
Heat transfer coeff	105.1173	104.6629	104.2086	101.9371	101.4828	99.2112	99.2112	98.7569	100.1198	101.4828	102.3914	103.3000	(39)
Average = Sum(39)m / 12 =												101.8235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8967	0.8928	0.8889	0.8695	0.8657	0.8463	0.8463	0.8424	0.8540	0.8657	0.8734	0.8812	(40)
HLP (average)												0.8686	
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		2.8519 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day)		135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:		
Store volume		269.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.7700 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.9558 (55)

Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)

If cylinder contains dedicated solar storage

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
									Total per year (kWh/year) = Sum(64)m =		2592.9170	(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

77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.0387	30.2328	24.5870	18.6139	13.9141	11.7469	12.6929	16.4988	22.1446	28.1177	32.8175	34.9847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)

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

	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	670.3116	668.1824	646.3770	605.6775	564.5053	527.3276	505.2754	508.4022	529.3538	566.7718	611.8659	651.2666	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.8000	0.7700	24.7170	(76)
West	4.6500	19.6403	0.5000	0.8000	0.7700	25.3159	(80)
West	9.5000	19.6403	0.5000	0.8000	0.7700	51.7207	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

Solar gains	109.0584	212.8859	352.9647	523.8291	653.4395	674.7892	639.9583	541.4380	412.9852	252.9157	135.8163	89.8375	(83)
Total gains	779.3700	881.0682	999.3417	1129.5066	1217.9448	1202.1167	1145.2337	1049.8402	942.3390	819.6874	747.6822	741.1041	(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	66.0399	66.3266	66.6157	68.1002	68.4051	69.9713	69.9713	70.2932	69.3363	68.4051	67.7981	67.2017	
alpha	5.4027	5.4218	5.4410	5.5400	5.5603	5.6648	5.6648	5.6862	5.6224	5.5603	5.5199	5.4801	
util living area													
	0.9930	0.9856	0.9616	0.8818	0.7229	0.5214	0.3802	0.4306	0.6939	0.9323	0.9862	0.9946	(86)
MIT	19.9283	20.1075	20.3984	20.7392	20.9304	20.9910	20.9987	20.9976	20.9593	20.6799	20.2473	19.9062	(87)
Th 2	20.1703	20.1736	20.1769	20.1935	20.1968	20.2134	20.2134	20.2167	20.2067	20.1968	20.1901	20.1835	(88)
util rest of house													
	0.9912	0.9818	0.9518	0.8550	0.6742	0.4601	0.3127	0.3584	0.6276	0.9103	0.9820	0.9931	(89)
MIT 2	19.1922	19.3720	19.6584	19.9898	20.1515	20.2091	20.2130	20.2159	20.1847	19.9464	19.5249	19.1809	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.4344	19.6140	19.9018	20.2363	20.4078	20.4664	20.4715	20.4731	20.4396	20.1878	19.7626	19.4195	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.7344	19.9140	20.2018	20.5363	20.7078	20.7664	20.7715	20.7731	20.7396	20.4878	20.0626	19.7195	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9805	0.9521	0.8670	0.7058	0.5034	0.3607	0.4098	0.6730	0.9191	0.9812	0.9921	(94)
Useful gains	771.5877	863.8453	951.5051	979.3266	859.5839	605.1542	413.0328	430.2410	634.1919	753.3373	733.6044	735.2564	(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													
	1622.4218	1571.4072	1427.8508	1186.1731	914.1321	611.7733	413.8618	431.8732	664.7513	1003.4364	1327.2576	1603.1687	(97)
Space heating kWh													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98a)
Space heating requirement - total per year (kWh/year)												2911.6474	
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													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2911.6474	
Space heating per m2											(98c) / (4) =	24.8371	(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)
Fraction of main heating from main system 2	0.0000 (203)
Fraction of total heating from main system 1	1.0000 (204)
Fraction of total heating from main system 2	0.0000 (205)
Efficiency of main space heating system 1 (in %)	100.0000 (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													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	633.0206	475.4816	354.4012	148.9295	40.5838	0.0000	0.0000	0.0000	0.0000	186.0737	427.4303	645.7268	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month													
	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	29.7939	23.9017	21.5209	15.7671	12.1790	9.9503	11.1101	14.4413	18.7578	24.6112	27.7983	30.6219	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-27.9196	-43.2471	-67.1004	-78.7733	-86.1716	-80.1433	-79.2030	-72.3881	-60.9707	-50.1124	-31.7517	-23.7078	(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	2911.6474	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	240.4535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-701.4891	(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	3917.8736	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2911.6474	16.4900	480.1307	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	16.4900	126.9957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	16.4900	114.9558	(249)
Energy for lighting	240.4535	16.4900	39.6508	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-701.4891	16.4900	-115.6755	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-115.6755	(252)
Total energy cost			646.0574	(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] =	1.4336	(257)
SAP value		76.7606	
SAP rating (Section 12)		77	(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	2911.6474	0.1564	455.2382	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			563.9759	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	240.4535	0.1443	34.7049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-701.4891	0.1337	-93.8048	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-93.8048	(269)
Total CO2, kg/year			601.5757	(272)
CO2 emissions per m2			5.1300	(273)
EI value			95.0311	
EI rating			95	(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)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(5)

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2. Ventilation rate

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.2167	0.1998	0.1955	0.1827	0.1827	0.1700	0.1700	0.1658	0.1700	0.1913	0.1870	0.1998	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.3297	0.3127	0.3085	0.2957	0.2957	0.2830	0.2830	0.2787	0.2830	0.3043	0.3000	0.3127	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	30.9000	2.4600	28.4400	0.1500	4.2660	60.0000	1706.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	29.2500	4.2100	25.0400	0.1500	3.7560	150.0000	3756.0000	(29a)
External Wall Floor 2	34.5000	12.0200	22.4800	0.1500	3.3720	150.0000	3372.0000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			231.9500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.6164			(33)
Party Wall Ground Floor			18.6000	0.0000	0.0000	70.0000	1302.0000	(32)
Party Wall Floor 1			43.7500	0.0000	0.0000	70.0000	3062.5000	(32)
Party Wall Floor 2			28.8600	0.0000	0.0000	70.0000	2020.2000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	24990.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		213.1790 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	13.9500	0.1600	2.2320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	1.3500	0.1000	0.1350
E16 Corner (normal)	12.0000	0.1000	1.2000
E18 Party wall between dwellings	14.2000	0.0600	0.8520
E20 Exposed floor (normal)	12.3000	0.2000	2.4600
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	12.0000	0.0600	0.7200
P1 Party wall - Ground floor	8.7500	0.0600	0.5250
P2 Party wall - Intermediate floor within a dwelling	13.3500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	2.6000	0.1500	0.3900
P8 Party Wall - Exposed floor (inverted)	11.3000	0.2000	2.2600
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200

R4 Ridge (vaulted ceiling)									7.4000	0.1000	0.7400		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												17.2515	(36)
Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss											(33) + (36) + (36a) =	69.8679	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.2493	33.4321	32.9777	31.6148	31.6148	30.2519	30.2519	29.7976	30.2519	32.5234	32.0691	33.4321	(38)
Heat transfer coeff	105.1173	103.3000	102.8457	101.4828	101.4828	100.1198	100.1198	99.6655	100.1198	102.3914	101.9371	103.3000	(39)
Average = Sum(39)m / 12 =												101.8235	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8967	0.8812	0.8773	0.8657	0.8657	0.8540	0.8540	0.8502	0.8540	0.8734	0.8695	0.8812	(40)
HLP (average)												0.8686	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8519	(42)
Hot water usage for mixer showers													
	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)
Hot water usage for baths													
	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)
Hot water usage for other uses													
	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)
Average daily hot water use (litres/day)												135.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)											Total = Sum(45)m =	2244.0500	
Distribution loss (46)m = 0.15 x (45)m													
	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss													
	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage													
	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2592.9170	(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													
	77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.0387	30.2328	24.5870	18.6139	13.9141	11.7469	12.6929	16.4988	22.1446	28.1177	32.8175	34.9847	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	670.3116	668.1824	646.3770	605.6775	564.5053	527.3276	505.2754	508.4022	529.3538	566.7718	611.8659	651.2666	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	25.9136	0.5000	0.8000	0.7700	32.6120	(76)
West	4.6500	25.9136	0.5000	0.8000	0.7700	33.4022	(80)
West	9.5000	25.9136	0.5000	0.8000	0.7700	68.2410	(80)
North	1.2800	20.9127	0.5600	0.7000	1.0000	9.4438	(82)

Solar gains	143.6990	239.9896	395.3941	595.5073	707.3994	789.4926	731.2543	633.4421	489.9491	301.5343	177.4026	112.9681	(83)
Total gains	814.0106	908.1720	1041.7711	1201.1848	1271.9047	1316.8202	1236.5296	1141.8443	1019.3029	868.3061	789.2684	764.2348	(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	66.0399	67.2017	67.4986	68.4051	68.4051	69.3363	69.3363	69.6523	69.3363	67.7981	68.1002	67.2017	
alpha	5.4027	5.4801	5.4999	5.5603	5.5603	5.6224	5.6224	5.6435	5.6224	5.5199	5.5400	5.4801	
util living area	0.9884	0.9790	0.9424	0.8312	0.6445	0.4238	0.2993	0.3226	0.5766	0.8789	0.9729	0.9908	(86)
MIT	20.0880	20.2425	20.5315	20.8258	20.9640	20.9971	20.9997	20.9995	20.9857	20.8037	20.4326	20.0754	(87)
Th 2	20.1703	20.1835	20.1868	20.1968	20.1968	20.2067	20.2067	20.2101	20.2067	20.1901	20.1935	20.1835	(88)
util rest of house	0.9852	0.9735	0.9280	0.7971	0.5908	0.3647	0.2353	0.2539	0.5056	0.8421	0.9643	0.9883	(89)
MIT 2	19.3507	19.5129	19.7937	20.0671	20.1753	20.2056	20.2067	20.2100	20.2002	20.0498	19.7090	19.3492	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.5933	19.7530	20.0364	20.3167	20.4348	20.4660	20.4676	20.4697	20.4586	20.2978	19.9471	19.5881	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.8933	20.0530	20.3364	20.6167	20.7348	20.7660	20.7676	20.7697	20.7586	20.5978	20.2471	19.8881	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9840	0.9724	0.9309	0.8156	0.6272	0.4064	0.2806	0.3026	0.5554	0.8617	0.9650	0.9871	(94)
Useful gains	800.9491	883.1483	969.8129	979.6611	797.7158	535.1776	346.9752	345.5282	566.1421	748.2583	761.6446	754.4063	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1523.4920	1482.6612	1340.7393	1118.0052	825.5437	537.2407	347.1729	345.8130	576.5518	900.8217	1207.6568	1486.2908	(97)
Space heating kWh	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98a)
Space heating requirement - total per year (kWh/year)												2315.8835	
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	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2315.8835	
Space heating per m2											(98c) / (4) =	19.7550	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	537.5719	402.8726	275.9692	99.6078	20.7040	0.0000	0.0000	0.0000	0.0000	113.5072	321.1287	544.5221	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	29.7939	23.9017	21.5209	15.7671	12.1790	9.9503	11.1101	14.4413	18.7578	24.6112	27.7983	30.6219	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.9700	-46.7454	-71.3543	-83.9436	-89.1447	-88.3476	-85.9587	-79.9070	-68.1852	-55.6300	-38.9299	-28.5329	(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												2315.8835	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												336.6824	
Water heating fuel used												770.1375	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	240.4535	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-771.6494	(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	3251.9494	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2315.8835	26.0600	603.5192	(240)
Space heating - main system 2	0.0000	26.0600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	26.0600	200.6978	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	26.0600	181.6706	(249)
Energy for lighting	240.4535	26.0600	62.6622	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	26.0600	-201.0918	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-201.0918	(252)
Total energy cost			847.4580	(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	2315.8835	0.1572	363.9685	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			472.7062	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	240.4535	0.1443	34.7049	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	0.1340	-103.3739	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-103.3739	(269)
Total CO2, kg/year			500.7369	(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	2315.8835	1.5818	3663.3195	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			4835.5407	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	240.4535	1.5338	368.8155	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-771.6494	1.4951	-1153.6696	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1153.6696	(283)
Total Primary energy kWh/year			5105.2963	(286)

Full SAP Calculation Printout

Property Reference	Plot 5	**Issued on Date**	03/09/2024
Assessment Reference	Be Green	**Prop Type Ref**	
Property			

SAP Rating	72 C	**DER**	6.42	**TER**	12.91
Environmental	94 A	**% DER < TER**			50.27
CO_2 Emissions (t/year)	0.6	**DFEE**	46.52	**TFEE**	47.93
Compliance Check	See BREL	**% DFEE < TFEE**			2.94
% DPER < TPER	3.25	**DPER**	65.60	**TPER**	67.80

Assessor Details	Mr. Josh Childs	**Assessor ID**	W470-0001
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)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 117.2300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

Effective ac	0.3489	0.3443	0.3396	0.3165	0.3119	0.2888	0.2888	0.2841	0.2980	0.3119	0.3211	0.3304	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000	(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559			(33)

Party Wall Floor 1	21.8800	0.0000	0.0000	70.0000	1531.6000 (32)
Party Wall Floor 2	14.4300	0.0000	0.0000	70.0000	1010.1000 (32)
Internal Wall Ground Floor	20.2500			9.0000	182.2500 (32c)
Internal Wall Floor 1	46.6300			9.0000	419.6700 (32c)
Internal Wall Floor 2	19.0300			9.0000	171.2700 (32c)
Internal Floor 1	22.7500			18.0000	409.5000 (32d)
Internal Ceiling Ground	22.7500			9.0000	204.7500 (32e)
Internal Ceiling Floor 1	51.1900			9.0000	460.7100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27713.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 236.4025 (35)
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	22.7000	0.1600	3.6320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	2.7000	0.1000	0.2700
E16 Corner (normal)	20.9000	0.1000	2.0900
E18 Party wall between dwellings	8.9000	0.0600	0.5340
E20 Exposed floor (normal)	9.7000	0.2000	1.9400
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2 Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025
P8 Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400
P5 Party wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1440 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.9999 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2937	36.7993	36.3049	33.8329	33.3385	30.8665	30.8665	30.3721	31.8553	33.3385	34.3273	35.3161	(38)
Heat transfer coeff	116.2937	115.7993	115.3049	112.8329	112.3385	109.8665	109.8665	109.3721	110.8553	112.3385	113.3273	114.3161	(39)

Average = Sum(39)m / 12 = 112.7093

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9920	0.9878	0.9836	0.9625	0.9583	0.9372	0.9372	0.9330	0.9456	0.9583	0.9667	0.9751	(40)
HLP (average)												0.9614	
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 2.8519 (42)
Hot water usage for mixer showers

72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:
Store volume 269.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.7700 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.9558 (55)
Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)

If cylinder contains dedicated solar storage

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)

Total per year (kWh/year) = Sum(64)m = 2592.9170 (64)
12Total per year (kWh/year) 2593 (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

77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)

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

	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	597.4466	613.3352	585.1510	563.0139	531.4176	510.4356	488.6870	489.4471	505.9956	524.8512	560.3694	583.5745	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.7000	0.7700	21.6274	(76)
West	4.6500	19.6403	0.5000	0.7000	0.7700	22.1514	(80)
West	9.5000	19.6403	0.5000	0.7000	0.7700	45.2556	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

Solar gains	96.3392	188.0044	311.9885	464.0677	580.1997	599.8152	568.5801	480.1251	365.3282	223.3917	119.9569	79.3778	(83)
Total gains	693.7858	801.3396	897.1394	1027.0816	1111.6173	1110.2507	1057.2671	969.5722	871.3238	748.2429	680.3263	662.9523	(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	66.1961	66.4787	66.7638	68.2264	68.5267	70.0686	70.0686	70.3853	69.4436	68.5267	67.9288	67.3412	
alpha	5.4131	5.4319	5.4509	5.5484	5.5684	5.6712	5.6712	5.6924	5.6296	5.5684	5.5286	5.4894	
util living area	0.9976	0.9942	0.9841	0.9396	0.8203	0.6150	0.4543	0.5129	0.7888	0.9682	0.9945	0.9981	(86)
MIT	19.7686	19.9473	20.2214	20.6034	20.8682	20.9798	20.9969	20.9942	20.9229	20.5598	20.1103	19.7558	(87)
Th 2	20.0900	20.0935	20.0970	20.1147	20.1183	20.1360	20.1360	20.1396	20.1289	20.1183	20.1112	20.1041	(88)
util rest of house	0.9968	0.9924	0.9790	0.9206	0.7718	0.5395	0.3666	0.4200	0.7185	0.9545	0.9925	0.9975	(89)
MIT 2	18.9623	19.1429	19.4167	19.7977	20.0313	20.1268	20.1352	20.1378	20.0869	19.7661	19.3198	18.9607	(90)
Living area fraction									fLA = Living area / (4) =			0.3290	(91)
MIT	19.2276	19.4076	19.6815	20.0628	20.3066	20.4075	20.4187	20.4196	20.3619	20.0273	19.5799	19.2223	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.5276	19.7076	19.9815	20.3628	20.6066	20.7075	20.7187	20.7196	20.6619	20.3273	19.8799	19.5223	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9914	0.9782	0.9265	0.7998	0.5901	0.4260	0.4831	0.7633	0.9583	0.9918	0.9970	(94)
Useful gains	691.1346	794.4374	877.6183	951.5404	889.1046	655.1884	450.3952	468.3627	665.1046	717.0169	674.7522	660.9595	(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	1770.8712	1714.7036	1554.4781	1293.3821	1000.5559	671.0045	452.5055	472.4407	727.4242	1092.7477	1448.3099	1751.5860	(97)
Space heating kWh	803.3240	618.4189	503.5837	246.1260	82.9198	0.0000	0.0000	0.0000	0.0000	279.5437	556.9616	811.4262	(98a)
Space heating requirement - total per year (kWh/year)												3902.3038	
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	803.3240	618.4189	503.5837	246.1260	82.9198	0.0000	0.0000	0.0000	0.0000	279.5437	556.9616	811.4262	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3902.3038	
Space heating per m2											(98c) / (4) =	33.2876	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	803.3240	618.4189	503.5837	246.1260	82.9198	0.0000	0.0000	0.0000	0.0000	279.5437	556.9616	811.4262	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	803.3240	618.4189	503.5837	246.1260	82.9198	0.0000	0.0000	0.0000	0.0000	279.5437	556.9616	811.4262	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.2486	-44.0017	-68.9511	-81.6265	-88.4544	-80.1563	-79.2174	-72.4040	-60.9858	-51.3387	-32.2164	-23.9569	(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	3902.3038	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-711.5578	(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	4902.9647	(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	3902.3038	0.1557	607.4602	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			716.1979	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-711.5578	0.1339	-95.2560	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-95.2560	(269)
Total CO2, kg/year			752.9965	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			6.4200	(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	3902.3038	1.5763	6151.2676	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			7323.4887	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	244.9569	1.5338	375.7231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-711.5578	1.4947	-1063.5950	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1063.5950	(283)
Total Primary energy kWh/year			7690.2265	(286)
Dwelling Primary energy Rate (DPER)			65.6000	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500 (1b) - (3b)	
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750 (1c) - (3c)	
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3735	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3455	(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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3196	0.3455	0.3714	0.3887	0.4059	(22b)
Effective ac	0.5970	0.5932	0.5896	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824	(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	
TER Opening Type (Uw = 1.20)			18.6900	1.1450	21.4008			(27)
Roof Windows F2			1.2800	1.5038	1.9248			(27a)
Ground Floor			42.9000	0.1300	5.5770			(28a)
Exposed Floor Garage			20.1500	0.1300	2.6195			(28b)
Exposed Floor Overhang			8.2900	0.1300	1.0777			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1800	8.4672			(29a)
Garage Wall	18.6000		18.6000	0.1800	3.3480			(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1800	8.4456			(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1800	6.6474			(29a)
External Roof	47.3600	1.2800	46.0800	0.1100	5.0688			(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.5768			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000			(32)
Party Wall Floor 2			14.4300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 236.4025 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	22.7000	0.1600	3.6320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0000	0.0000
E13	Gable (insulation at rafter level)	14.3200	0.0800	1.1456
E14	Flat roof	2.7000	0.0800	0.2160
E16	Corner (normal)	20.9000	0.0900	1.8810
E18	Party wall between dwellings	8.9000	0.0600	0.5340
E20	Exposed floor (normal)	9.7000	0.3200	3.1040
E21	Exposed floor (inverted)	6.2000	0.3200	1.9840
E25	Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2	Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	1.3500	0.1200	0.1620
P8	Party Wall - Exposed floor (inverted)	8.7500	0.2400	2.1000
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	3.2000	0.0800	0.2560
R4	Ridge (vaulted ceiling)	7.4000	0.0800	0.5920
P5	Party wall - Roof (insulation at rafter level)	7.4000	0.0800	0.5920

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.6641 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 83.2409 (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	63.8186	63.4159	63.0212	61.1673	60.8204	59.2057	59.2057	58.9067	59.8277	60.8204	61.5221	62.2557	(38)
Heat transfer coeff	147.0595	146.6568	146.2621	144.4082	144.0613	142.4466	142.4466	142.1476	143.0685	144.0613	144.7630	145.4966	(39)
Average = Sum(39)m / 12 =												144.4065	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2545	1.2510	1.2477	1.2318	1.2289	1.2151	1.2151	1.2126	1.2204	1.2289	1.2349	1.2411	(40)
HLP (average)												1.2318	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8519 (42)

Hot water usage for mixer showers	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616 (42a)
Hot water usage for baths	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966 (42b)
Hot water usage for other uses	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368 (42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	279.3691	246.9084	261.7934	228.8100	220.9055	198.0688	194.7002	202.9386	205.7396	230.6113	246.6953	276.1271	(62)
WWHRS	-32.9326	-29.1258	-30.4989	-25.2543	-23.5361	-20.1400	-18.8780	-20.0749	-20.8376	-24.5653	-27.8295	-32.3227	(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	246.4365	217.7826	231.2945	203.5557	197.3694	177.9288	175.8222	182.8637	184.9020	206.0461	218.8658	243.8044	(64)
										Total per year (kWh/year) = Sum(64)m =		2486.6718	(64)
12Total per year (kWh/year)												2487	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	114.6733	101.7721	108.8294	97.1598	95.2342	86.9383	86.5209	89.2602	89.4888	98.4614	103.1066	113.5954	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	154.1308	151.4466	146.2761	134.9441	128.0029	120.7477	116.2916	119.9734	124.2901	132.3406	143.2036	152.6820	(72)
Total internal gains	650.5486	666.4372	638.2530	616.1160	584.5196	560.5376	538.7891	539.5491	556.0977	577.9532	613.4714	636.6765	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(76)
West	14.1500	19.6403	0.6300	0.7000	0.7700	84.9328	(80)
North	1.2800	16.1759	0.6300	0.7000	1.0000	8.2179	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	120.4012	235.0179	389.7096	578.5506	721.9363	745.6425	707.1050	598.0814	456.0301	279.2158	149.9386	99.1844	(83)
Total gains	770.9499	901.4552	1027.9626	1194.6666	1306.4559	1306.1801	1245.8941	1137.6306	1012.1278	857.1691	763.4101	735.8610	(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	52.3474	52.4912	52.6328	53.3085	53.4369	54.0426	54.0426	54.1563	53.8077	53.4369	53.1779	52.9097	
alpha	4.4898	4.4994	4.5089	4.5539	4.5625	4.6028	4.6028	4.6104	4.5872	4.5625	4.5452	4.5273	
util living area	0.9962	0.9918	0.9800	0.9363	0.8304	0.6515	0.4923	0.5549	0.8106	0.9649	0.9924	0.9969	(86)
MIT	19.4187	19.6247	19.9555	20.4084	20.7600	20.9427	20.9873	20.9786	20.8428	20.3682	19.8203	19.3933	(87)
Th 2	19.8767	19.8794	19.8821	19.8946	19.8970	19.9079	19.9079	19.9100	19.9037	19.8970	19.8922	19.8872	(88)
util rest of house	0.9950	0.9892	0.9732	0.9146	0.7765	0.5582	0.3755	0.4330	0.7316	0.9487	0.9895	0.9960	(89)
MIT 2	18.0450	18.3094	18.7303	19.2970	19.6959	19.8753	19.9039	19.9023	19.7950	19.2614	18.5692	18.0198	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	18.4970	18.7421	19.1334	19.6626	20.0460	20.2265	20.2603	20.2564	20.1397	19.6256	18.9808	18.4717	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4970	18.7421	19.1334	19.6626	20.0460	20.2265	20.2603	20.2564	20.1397	19.6256	18.9808	18.4717	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9928	0.9854	0.9672	0.9091	0.7846	0.5868	0.4140	0.4731	0.7507	0.9435	0.9860	0.9941	(94)
Useful gains	765.3764	888.3125	994.2123	1086.0856	1025.0214	766.5016	515.8589	538.2083	759.7960	808.7582	752.7079	731.5110	(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	2087.7997	2030.0443	1847.7851	1554.2133	1202.3384	801.4709	521.4018	548.1806	864.0941	1300.2385	1719.9027	2076.4767	(97)
Space heating kWh													

	983.8830	767.2438	635.0582	337.0519	131.9239	0.0000	0.0000	0.0000	0.0000	365.6614	696.3803	1000.6545 (98a)
Space heating requirement - total per year (kWh/year)												4917.8568
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												
	983.8830	767.2438	635.0582	337.0519	131.9239	0.0000	0.0000	0.0000	0.0000	365.6614	696.3803	1000.6545 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4917.8568
Space heating per m2											(98c) / (4) =	41.9505 (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													
	983.8830	767.2438	635.0582	337.0519	131.9239	0.0000	0.0000	0.0000	0.0000	365.6614	696.3803	1000.6545	(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)													
	1065.9620	831.2500	688.0370	365.1700	142.9294	0.0000	0.0000	0.0000	0.0000	396.1662	754.4748	1084.1327	(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													
	246.4365	217.7826	231.2945	203.5557	197.3694	177.9288	175.8222	182.8637	184.9020	206.0461	218.8658	243.8044	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8383	86.6396	86.2044	85.1826	83.1773	79.8000	79.8000	79.8000	79.8000	85.3315	86.4680	86.8803	(217)
Fuel for water heating, kWh/month													
	283.7879	251.3661	268.3095	238.9639	237.2874	222.9684	220.3286	229.1526	231.7067	241.4654	253.1178	280.6209	(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	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.4483	-59.1238	-85.9577	-97.7567	-106.3027	-99.4795	-98.1926	-92.2329	-81.9066	-68.0510	-45.7893	-35.7493	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-21.3658	-45.1680	-90.2065	-136.1354	-180.6702	-181.8300	-179.7517	-151.9445	-110.9969	-64.8823	-28.6146	-16.8839	(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	5328.1222 (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	2959.0751 (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)	244.9569 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2120.4400 (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	6497.7142 (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	5328.1222	0.2100	1118.9057	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2959.0751	0.2100	621.4058	(264)
Space and water heating			1740.3114	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-911.9903	0.1344	-122.5344	
PV Unit electricity exported	-1208.4497	0.1257	-151.9583	
Total			-274.4927	(269)
Total CO2, kg/year			1513.1028	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.9100	(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	5328.1222	1.1300	6020.7781	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2959.0751	1.1300	3343.7549	(278)
Space and water heating			9364.5329	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	244.9569	1.5338	375.7231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-911.9903	1.4966	-1364.8454	
PV Unit electricity exported	-1208.4497	0.4616	-557.7821	
Total			-1922.6274	(283)
Total Primary energy kWh/year			7947.7294	(286)
Target Primary Energy Rate (TPER)			67.8000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3235	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2992	(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	0.3815	0.3740	0.3665	0.3291	0.3217	0.2843	0.2843	0.2768	0.2992	0.3217	0.3366	0.3516	(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	0.5728	0.5699	0.5672	0.5542	0.5517	0.5404	0.5404	0.5383	0.5448	0.5517	0.5567	0.5618	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000	(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000	70.0000	1531.6000	(32)
Party Wall Floor 2			14.4300	0.0000	0.0000	70.0000	1010.1000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27713.4700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		236.4025	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720	
E3 Sill	10.7300	0.0500	0.5365	
E4 Jamb	13.4600	0.0500	0.6730	
E5 Ground floor (normal)	22.7000	0.1600	3.6320	
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000	
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760	
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320	
E14 Flat roof	2.7000	0.1000	0.2700	
E16 Corner (normal)	20.9000	0.1000	2.0900	
E18 Party wall between dwellings	8.9000	0.0600	0.5340	
E20 Exposed floor (normal)	9.7000	0.2000	1.9400	
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400	
E25 Staggered party wall between dwellings	6.0000	0.0600	0.3600	
P2 Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025	
P8 Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500	
R1 Head of roof window	1.6000	0.1000	0.1600	
R2 Sill of roof window	1.6000	0.0800	0.1280	
R3 Jamb of roof window	3.2000	0.1000	0.3200	
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400	
P5 Party wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1440 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.9999 (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	61.2279	60.9258	60.6297	59.2389	58.9787	57.7674	57.7674	57.5431	58.2340	58.9787	59.5051	60.0554	(38)
Heat transfer coeff	140.2278	139.9257	139.6297	138.2389	137.9787	136.7674	136.7674	136.5430	137.2339	137.9787	138.5051	139.0554	(39)

Average = Sum(39)m / 12 = 138.2376

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1962	1.1936	1.1911	1.1792	1.1770	1.1667	1.1667	1.1647	1.1706	1.1770	1.1815	1.1862	(40)
HLP (average)												1.1792	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8519 (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

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 68.6878 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	74.9385	72.8825	70.6380	67.8446	65.3525	62.7627	62.2248	64.4648	66.7621	69.4217	72.2398	74.8334	(44)
Energy conte	118.6843	103.7838	108.5680	92.8759	87.9770	77.1740	75.2555	79.8208	82.3243	94.2046	102.9188	117.1710	(45)

Energy content (annual) Total = Sum(45)m = 1140.7580

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

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

Water storage loss:

Total storage loss

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

If cylinder contains dedicated solar storage

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

Total heat required for water heating calculated for each month

100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(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

100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(64)

Total per year (kWh/year) = Sum(64)m = 969.6443 (64)

12Total per year (kWh/year) 970 (64)

Electric shower(s)

57.6901	51.4023	56.1294	53.5636	54.5687	52.0532	53.7883	54.5687	53.5636	56.1294	55.0739	57.6901	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 656.2213 (64a)

Heat gains from water heating, kWh/month

39.6429	34.9046	37.1030	33.1270	32.3373	29.4128	29.4389	30.6041	30.8848	34.0508	35.6387	39.3213	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	53.2835	51.9414	49.8697	46.0098	43.4641	40.8511	39.5684	41.1345	42.8956	45.7672	49.4982	52.8513	(72)
Total internal gains	546.7013	563.9320	538.8466	524.1816	496.9808	480.6410	462.0658	460.7103	474.7032	488.3799	516.7660	533.8458	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a	g Specific data	FF Specific data	Access factor	Gains W

		W/m2	or Table 6b	or Table 6c	Table 6d		
East	4.5400	19.6403	0.5000	0.7000	0.7700	21.6274	(76)
West	4.6500	19.6403	0.5000	0.7000	0.7700	22.1514	(80)
West	9.5000	19.6403	0.5000	0.7000	0.7700	45.2556	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	96.3392	188.0044	311.9885	464.0677	580.1997	599.8152	568.5801	480.1251	365.3282	223.3917	119.9569	79.3778	(83)
Total gains	643.0405	751.9364	850.8350	988.2493	1077.1805	1080.4562	1030.6459	940.8354	840.0314	711.7716	636.7230	613.2237	(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	54.8977	55.0162	55.1329	55.6876	55.7926	56.2867	56.2867	56.3792	56.0954	55.7926	55.5805	55.3606	
alpha	4.6598	4.6677	4.6755	4.7125	4.7195	4.7524	4.7524	4.7586	4.7397	4.7195	4.7054	4.6907	
util living area	0.9982	0.9960	0.9899	0.9639	0.8889	0.7296	0.5642	0.6316	0.8713	0.9812	0.9963	0.9986	(86)
MIT	19.3899	19.5749	19.8790	20.3158	20.6904	20.9171	20.9806	20.9678	20.7954	20.2998	19.7739	19.3642	(87)
Th 2	19.9231	19.9251	19.9271	19.9367	19.9385	19.9468	19.9468	19.9483	19.9436	19.9385	19.9348	19.9311	(88)
util rest of house	0.9977	0.9947	0.9863	0.9503	0.8466	0.6385	0.4389	0.5041	0.8061	0.9719	0.9949	0.9982	(89)
MIT 2	18.4556	18.6416	18.9452	19.3793	19.7248	19.9074	19.9416	19.9386	19.8248	19.3712	18.8480	18.4361	(90)
Living area fraction									fLA = Living area / (4) =			0.3290	(91)
MIT	18.7630	18.9487	19.2524	19.6874	20.0424	20.2396	20.2835	20.2772	20.1441	19.6767	19.1527	18.7414	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7630	18.9487	19.2524	19.6874	20.0424	20.2396	20.2835	20.2772	20.1441	19.6767	19.1527	18.7414	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9930	0.9832	0.9464	0.8514	0.6658	0.4803	0.5461	0.8205	0.9688	0.9933	0.9974	(94)
Useful gains	640.9575	746.6812	836.5555	935.2395	917.0753	719.3616	495.0551	513.8315	689.2486	689.5474	632.4820	611.6367	(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	2028.1188	1965.7687	1780.6180	1491.2434	1151.0800	771.3131	503.7760	529.4038	829.4574	1252.3905	1669.3562	2022.0657	(97)
Space heating kWh	1032.0480	819.2268	702.3825	400.3228	174.0995	0.0000	0.0000	0.0000	0.0000	418.7552	746.5494	1049.3592	(98a)
Space heating requirement - total per year (kWh/year)												5342.7434	
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	1032.0480	819.2268	702.3825	400.3228	174.0995	0.0000	0.0000	0.0000	0.0000	418.7552	746.5494	1049.3592	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5342.7434	
Space heating per m2										(98c) / (4) =		45.5749	(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	1285.6131	1012.0784	1037.7271	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7916	0.8692	0.8247	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1017.7370	879.6997	855.8531	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1186.9881	1132.7079	1033.7038	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	121.8608	188.2382	132.3209	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	30.4652	47.0595	33.0802	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												110.6050	(107)
Energy for space heating												45.5749	(99)
Energy for space cooling												0.9435	(108)
Total												46.5184	(109)
Fabric Energy Efficiency (DFEE)												46.5	(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)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	323.9305	(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) =	0.1235	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3735	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3455	(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	0.4405	0.4318	0.4232	0.3800	0.3714	0.3282	0.3282	0.3196	0.3455	0.3714	0.3887	0.4059	(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	0.5970	0.5932	0.5896	0.5722	0.5690	0.5539	0.5539	0.5511	0.5597	0.5690	0.5755	0.5824	(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	
TER Opening Type (Uw = 1.20)			18.6900	1.1450	21.4008			(27)
Roof Windows F2			1.2800	1.5038	1.9248			(27a)
Ground Floor			42.9000	0.1300	5.5770			(28a)
Exposed Floor Garage			20.1500	0.1300	2.6195			(28b)
Exposed Floor Overhang			8.2900	0.1300	1.0777			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1800	8.4672			(29a)
Garage Wall	18.6000		18.6000	0.1800	3.3480			(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1800	8.4456			(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1800	6.6474			(29a)
External Roof	47.3600	1.2800	46.0800	0.1100	5.0688			(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		64.5768			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000			(32)
Party Wall Floor 2			14.4300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 236.4025 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	22.7000	0.1600	3.6320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0000	0.0000
E13	Gable (insulation at rafter level)	14.3200	0.0800	1.1456
E14	Flat roof	2.7000	0.0800	0.2160
E16	Corner (normal)	20.9000	0.0900	1.8810
E18	Party wall between dwellings	8.9000	0.0600	0.5340
E20	Exposed floor (normal)	9.7000	0.3200	3.1040
E21	Exposed floor (inverted)	6.2000	0.3200	1.9840
E25	Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2	Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	1.3500	0.1200	0.1620
P8	Party Wall - Exposed floor (inverted)	8.7500	0.2400	2.1000
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	3.2000	0.0800	0.2560
R4	Ridge (vaulted ceiling)	7.4000	0.0800	0.5920
P5	Party wall - Roof (insulation at rafter level)	7.4000	0.0800	0.5920

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.6641 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 83.2409 (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	63.8186	63.4159	63.0212	61.1673	60.8204	59.2057	59.2057	58.9067	59.8277	60.8204	61.5221	62.2557	(38)
Heat transfer coeff	147.0595	146.6568	146.2621	144.4082	144.0613	142.4466	142.4466	142.1476	143.0685	144.0613	144.7630	145.4966	(39)

Average = Sum(39)m / 12 = 144.4065

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2545	1.2510	1.2477	1.2318	1.2289	1.2151	1.2151	1.2126	1.2204	1.2289	1.2349	1.2411	(40)
HLP (average)												1.2318	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8519 (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

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 68.6878 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	74.9385	72.8825	70.6380	67.8446	65.3525	62.7627	62.2248	64.4648	66.7621	69.4217	72.2398	74.8334	(44)
Energy conte	118.6843	103.7838	108.5680	92.8759	87.9770	77.1740	75.2555	79.8208	82.3243	94.2046	102.9188	117.1710	(45)
Energy content (annual)										Total = Sum(45)m =		1140.7580	
Distribution loss (46)m = 0.15 x (45)m													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(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													
	100.8816	88.2162	92.2828	78.9445	74.7805	65.5979	63.9672	67.8477	69.9757	80.0739	87.4810	99.5953	(64)
										Total per year (kWh/year) = Sum(64)m =		969.6443	(64)
12Total per year (kWh/year)												970	(64)
Electric shower(s)													
	57.6901	51.4023	56.1294	53.5636	54.5687	52.0532	53.7883	54.5687	53.5636	56.1294	55.0739	57.6901	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						656.2213	(64a)
Heat gains from water heating, kWh/month													
	39.6429	34.9046	37.1030	33.1270	32.3373	29.4128	29.4389	30.6041	30.8848	34.0508	35.6387	39.3213	(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	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	142.5973	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	146.0767	161.7278	146.0767	150.9460	146.0767	150.9460	146.0767	146.0767	150.9460	146.0767	150.9460	146.0767	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	281.5619	284.4836	277.1210	261.4467	241.6608	223.0648	210.6416	207.7198	215.0825	230.7567	250.5427	269.1387	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	37.2597	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	53.2835	51.9414	49.8697	46.0098	43.4641	40.8511	39.5684	41.1345	42.8956	45.7672	49.4982	52.8513	(72)
Total internal gains													
	546.7013	563.9320	538.8466	524.1816	496.9808	480.6410	462.0658	460.7103	474.7032	488.3799	516.7660	533.8458	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.6300	0.7000	0.7700	27.2505	(76)
West	14.1500	19.6403	0.6300	0.7000	0.7700	84.9328	(80)
North	1.2800	16.1759	0.6300	0.7000	1.0000	8.2179	(82)

Solar gains	120.4012	235.0179	389.7096	578.5506	721.9363	745.6425	707.1050	598.0814	456.0301	279.2158	149.9386	99.1844	(83)
Total gains	667.1026	798.9500	928.5561	1102.7323	1218.9171	1226.2835	1169.1709	1058.7917	930.7333	767.5957	666.7047	633.0303	(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	52.3474	52.4912	52.6328	53.3085	53.4369	54.0426	54.0426	54.1563	53.8077	53.4369	53.1779	52.9097	
alpha	4.4898	4.4994	4.5089	4.5539	4.5625	4.6028	4.6028	4.6104	4.5872	4.5625	4.5452	4.5273	
util living area													
	0.9979	0.9949	0.9863	0.9508	0.8567	0.6833	0.5215	0.5901	0.8443	0.9764	0.9956	0.9984	(86)
MIT	19.3228	19.5317	19.8696	20.3425	20.7218	20.9304	20.9839	20.9726	20.8102	20.2951	19.7320	19.2978	(87)
Th 2	19.8767	19.8794	19.8821	19.8946	19.8970	19.9079	19.9079	19.9100	19.9037	19.8970	19.8922	19.8872	(88)
util rest of house													
	0.9972	0.9933	0.9815	0.9331	0.8070	0.5892	0.3993	0.4634	0.7712	0.9647	0.9938	0.9978	(89)
MIT 2	18.3538	18.5639	18.9009	19.3689	19.7113	19.8763	19.9039	19.9021	19.7976	19.3333	18.7739	18.3368	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	18.6726	18.8823	19.2196	19.6892	20.0438	20.2231	20.2592	20.2543	20.1307	19.6497	19.0892	18.6530	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6726	18.8823	19.2196	19.6892	20.0438	20.2231	20.2592	20.2543	20.1307	19.6497	19.0892	18.6530	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9912	0.9777	0.9290	0.8144	0.6181	0.4398	0.5052	0.7886	0.9613	0.9920	0.9969	(94)
Useful gains	664.5227	791.8920	907.8390	1024.4822	992.7464	757.9110	514.1550	534.8776	733.9540	737.8757	661.3714	631.0984	(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													
	2113.6330	2050.5971	1860.4012	1558.0521	1202.0142	800.9904	521.2437	547.8785	862.8105	1303.7152	1735.5872	2102.8607	(97)
Space heating kWh													
	1078.1380	845.8499	708.7063	384.1703	155.6953	0.0000	0.0000	0.0000	0.0000	420.9846	773.4353	1094.9911	(98a)
Space heating requirement - total per year (kWh/year)												5461.9708	
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

1078.1380	845.8499	708.7063	384.1703	155.6953	0.0000	0.0000	0.0000	0.0000	420.9846	773.4353	1094.9911	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 5461.9708

Space heating per m2 (98c) / (4) = 46.5919 (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	1338.9978	1054.1047	1080.3214	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8266	0.8942	0.8530	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1106.8404	942.5586	921.5562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1355.8529	1293.1655	1170.4999	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	179.2890	260.8515	185.2141	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	44.8222	65.2129	46.3035	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling requirement 156.3386 (107)

Energy for space heating 46.5919 (99)

Energy for space cooling 1.3336 (108)

Total 47.9255 (109)

Fabric Energy Efficiency (TFEE) 47.9 (109)

SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)

CALCULATION OF ENERGY RATING

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(5)

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2. Ventilation rate

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

	Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2000 (18)
Number of sides sheltered		1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850 (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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation 0.5000 (23a)

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

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 77.4000 (23c)

Effective ac	0.3489	0.3443	0.3396	0.3165	0.3119	0.2888	0.2888	0.2841	0.2980	0.3119	0.3211	0.3304	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)

External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000 (29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000 (29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000 (29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000 (29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200 (30)
Total net area of external elements Aum(A, m2)			286.8800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559		(33)
Party Wall Floor 1			21.8800	0.0000	0.0000	70.0000	1531.6000 (32)
Party Wall Floor 2			14.4300	0.0000	0.0000	70.0000	1010.1000 (32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500 (32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700 (32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700 (32c)
Internal Floor 1			22.7500			18.0000	409.5000 (32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500 (32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27713.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 236.4025 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E1 Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3 Sill	10.7300	0.0500	0.5365
E4 Jamb	13.4600	0.0500	0.6730
E5 Ground floor (normal)	22.7000	0.1600	3.6320
E6 Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13 Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14 Flat roof	2.7000	0.1000	0.2700
E16 Corner (normal)	20.9000	0.1000	2.0900
E18 Party wall between dwellings	8.9000	0.0600	0.5340
E20 Exposed floor (normal)	9.7000	0.2000	1.9400
E21 Exposed floor (inverted)	6.2000	0.2000	1.2400
E25 Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2 Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025
P8 Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500
R1 Head of roof window	1.6000	0.1000	0.1600
R2 Sill of roof window	1.6000	0.0800	0.1280
R3 Jamb of roof window	3.2000	0.1000	0.3200
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400
P5 Party wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1440 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.9999 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2937	36.7993	36.3049	33.8329	33.3385	30.8665	30.8665	30.3721	31.8553	33.3385	34.3273	35.3161	(38)
Heat transfer coeff	116.2937	115.7993	115.3049	112.8329	112.3385	109.8665	109.8665	109.3721	110.8553	112.3385	113.3273	114.3161	(39)
Average = Sum(39)m / 12 =												112.7093	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9920	0.9878	0.9836	0.9625	0.9583	0.9372	0.9372	0.9330	0.9456	0.9583	0.9667	0.9751	(40)
HLP (average)												0.9614	
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 2.8519 (42)
Hot water usage for mixer showers

72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)

Hot water usage for baths

31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)

Hot water usage for other uses

43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	

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

34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)

Water storage loss:
Store volume 269.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.7700 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.9558 (55)
Total storage loss

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)

If cylinder contains dedicated solar storage

29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter -0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

Output from w/h

262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
									Total per year (kWh/year) = Sum(64)m =		2592.9170	(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

77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.6762	30.7991	25.0475	18.9626	14.1747	11.9669	12.9307	16.8078	22.5594	28.6443	33.4321	35.6399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	670.9491	668.7486	646.8375	606.0262	564.7659	527.5476	505.5131	508.7112	529.7685	567.2984	612.4805	651.9219	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.7000	0.7700	21.6274	(76)
West	4.6500	19.6403	0.5000	0.7000	0.7700	22.1514	(80)
West	9.5000	19.6403	0.5000	0.7000	0.7700	45.2556	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

Solar gains	96.3392	188.0044	311.9885	464.0677	580.1997	599.8152	568.5801	480.1251	365.3282	223.3917	119.9569	79.3778	(83)
Total gains	767.2883	856.7530	958.8260	1070.0938	1144.9656	1127.3628	1074.0932	988.8364	895.0967	790.6901	732.4374	731.2997	(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	66.1961	66.4787	66.7638	68.2264	68.5267	70.0686	70.0686	70.3853	69.4436	68.5267	67.9288	67.3412	
alpha	5.4131	5.4319	5.4509	5.5484	5.5684	5.6712	5.6712	5.6924	5.6296	5.5684	5.5286	5.4894	
util living area													
	0.9960	0.9920	0.9788	0.9298	0.8064	0.6068	0.4474	0.5034	0.7753	0.9602	0.9922	0.9969	(86)
MIT	19.8397	19.9998	20.2763	20.6331	20.8796	20.9811	20.9971	20.9947	20.9295	20.5943	20.1599	19.8224	(87)
Th 2	20.0900	20.0935	20.0970	20.1147	20.1183	20.1360	20.1360	20.1396	20.1289	20.1183	20.1112	20.1041	(88)
util rest of house													
	0.9948	0.9896	0.9722	0.9086	0.7567	0.5319	0.3610	0.4120	0.7040	0.9437	0.9894	0.9960	(89)
MIT 2	19.0330	19.1948	19.4698	19.8243	20.0396	20.1274	20.1352	20.1380	20.0909	19.7979	19.3688	19.0270	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.2984	19.4596	19.7352	20.0904	20.3159	20.4083	20.4188	20.4199	20.3668	20.0599	19.6291	19.2887	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.5984	19.7596	20.0352	20.3904	20.6159	20.7083	20.7188	20.7199	20.6668	20.3599	19.9291	19.5887	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9885	0.9717	0.9158	0.7858	0.5822	0.4195	0.4741	0.7497	0.9489	0.9887	0.9953	(94)
Useful gains	762.6672	846.9023	931.6730	980.0388	899.7618	656.2993	450.5668	468.7601	671.0424	750.2541	724.1346	727.8359	(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													
	1779.1059	1720.7365	1560.6718	1296.4959	1001.6015	671.0969	452.5186	472.4712	727.9655	1096.4118	1453.8836	1759.1732	(97)
Space heating kWh													
	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98a)
Space heating requirement - total per year (kWh/year)												3665.3154	
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													
	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3665.3154	
Space heating per m2											(98c) / (4) =	31.2660	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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													
	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98)
Space heating efficiency (main heating system 1)													
	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)													
	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)

Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month													
	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.1644	-43.8500	-68.5465	-81.1330	-88.0877	-80.1563	-79.2174	-72.4040	-60.9858	-51.0721	-32.1118	-23.8955	(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												3665.3154	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												336.6824	
Water heating fuel used												770.1375	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)													
mechanical ventilation fans (SFP = 1.7640)												697.1244	(230a)
Total electricity for the above, kWh/year												697.1244	(231)
Electricity for lighting (calculated in Appendix L)												244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-709.6246	(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												4667.9095	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3665.3154	16.4900	604.4105	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	16.4900	126.9957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	16.4900	114.9558	(249)
Energy for lighting	244.9569	16.4900	40.3934	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-709.6246	16.4900	-117.0171	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-117.0171	(252)
Total energy cost			769.7383	(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] =	1.7081	(257)
SAP value		72.3116	
SAP rating (Section 12)		72	(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	3665.3154	0.1557	570.8406	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			679.5782	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-709.6246	0.1338	-94.9751	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-94.9751	(269)
Total CO2, kg/year			716.6578	(272)
CO2 emissions per m2			6.1100	(273)
EI value			94.0805	
EI rating			94	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(5)

2. Ventilation rate

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

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.2359	0.2174	0.2128	0.1989	0.1989	0.1850	0.1850	0.1804	0.1850	0.2081	0.2035	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3489	0.3304	0.3257	0.3119	0.3119	0.2980	0.2980	0.2934	0.2980	0.3211	0.3165	0.3304	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000	(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000	70.0000	1531.6000	(32)
Party Wall Floor 2			14.4300	0.0000	0.0000	70.0000	1010.1000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	27713.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		236.4025 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	22.7000	0.1600	3.6320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13	Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14	Flat roof	2.7000	0.1000	0.2700
E16	Corner (normal)	20.9000	0.1000	2.0900
E18	Party wall between dwellings	8.9000	0.0600	0.5340
E20	Exposed floor (normal)	9.7000	0.2000	1.9400
E21	Exposed floor (inverted)	6.2000	0.2000	1.2400
E25	Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2	Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025
P8	Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500

R1 Head of roof window	1.6000	0.1000	0.1600	
R2 Sill of roof window	1.6000	0.0800	0.1280	
R3 Jamb of roof window	3.2000	0.1000	0.3200	
R4 Ridge (vaulted ceiling)	7.4000	0.1000	0.7400	
P5 Party wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1440 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.9999 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2937	35.3161	34.8217	33.3385	33.3385	31.8553	31.8553	31.3609	31.8553	34.3273	33.8329	35.3161	(38)
Heat transfer coeff	116.2937	114.3161	113.8217	112.3385	112.3385	110.8553	110.8553	110.3609	110.8553	113.3273	112.8329	114.3161	(39)
Average = Sum(39)m / 12 =												112.7093	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9920	0.9751	0.9709	0.9583	0.9583	0.9456	0.9456	0.9414	0.9456	0.9667	0.9625	0.9751	(40)
HLP (average)												0.9614	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8519 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)
Hot water usage for baths	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)
Hot water usage for other uses	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)
Average daily hot water use (litres/day)												135.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2592.9170	(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	77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.6762	30.7991	25.0475	18.9626	14.1747	11.9669	12.9307	16.8078	22.5594	28.6443	33.4321	35.6399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains	670.9491	668.7486	646.8375	606.0262	564.7659	527.5476	505.5131	508.7112	529.7685	567.2984	612.4805	651.9219	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	25.9136	0.5000	0.7000	0.7700	28.5355	(76)
West	4.6500	25.9136	0.5000	0.7000	0.7700	29.2269	(80)
West	9.5000	25.9136	0.5000	0.7000	0.7700	59.7109	(80)
North	1.2800	20.9127	0.5600	0.7000	1.0000	9.4438	(82)

Solar gains	126.9171	211.9569	349.6351	527.9004	628.5312	702.2264	650.1207	562.0819	433.6356	266.3907	156.6707	99.7905	(83)
Total gains	797.8662	880.7056	996.4726	1133.9266	1193.2971	1229.7740	1155.6338	1070.7931	963.4042	833.6890	769.1512	751.7123	(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	66.1961	67.3412	67.6337	68.5267	68.5267	69.4436	69.4436	69.7547	69.4436	67.9288	68.2264	67.3412	
alpha	5.4131	5.4894	5.5089	5.5684	5.5684	5.6296	5.6296	5.6503	5.6296	5.5286	5.5484	5.4894	
util living area	0.9934	0.9884	0.9676	0.8943	0.7338	0.4994	0.3543	0.3803	0.6614	0.9242	0.9845	0.9948	(86)
MIT	19.9936	20.1316	20.4113	20.7356	20.9326	20.9934	20.9992	20.9989	20.9722	20.7306	20.3416	19.9878	(87)
Th 2	20.0900	20.1041	20.1076	20.1183	20.1183	20.1289	20.1289	20.1324	20.1289	20.1112	20.1147	20.1041	(88)
util rest of house	0.9913	0.9847	0.9575	0.8647	0.6741	0.4243	0.2712	0.2917	0.5774	0.8935	0.9787	0.9931	(89)
MIT 2	19.1862	19.3338	19.6094	19.9188	20.0784	20.1264	20.1287	20.1322	20.1166	19.9161	19.5508	19.1918	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.4519	19.5963	19.8732	20.1875	20.3595	20.4117	20.4151	20.4174	20.3981	20.1841	19.8110	19.4537	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.7519	19.8963	20.1732	20.4875	20.6595	20.7117	20.7151	20.7174	20.6981	20.4841	20.1110	19.7537	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9837	0.9584	0.8779	0.7117	0.4748	0.3272	0.3516	0.6333	0.9076	0.9786	0.9922	(94)
Useful gains	790.1336	866.3779	954.9871	995.4942	849.2932	583.9323	378.1108	376.4732	610.1506	756.6915	752.7128	745.8793	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1669.0296	1622.8644	1465.2532	1223.0873	905.3864	588.8272	378.5869	377.1457	631.6658	984.1435	1321.3880	1629.4279	(97)
Space heating kWh	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98a)
Space heating requirement - total per year (kWh/year)												2983.5266	
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	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2983.5266	
Space heating per m2											(98c) / (4) =	25.4502	(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)
Fraction of main heating from main system 2	0.0000	(203)
Fraction of total heating from main system 1	1.0000	(204)
Fraction of total heating from main system 2	0.0000	(205)
Efficiency of main space heating system 1 (in %)	100.0000	(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	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.3469	-47.4781	-73.0680	-86.4518	-90.4851	-88.3630	-85.9754	-79.9259	-68.2035	-56.7334	-39.4803	-28.8019	(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	2983.5266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)

mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)

Electricity for lighting (calculated in Appendix L)	244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-780.3134	(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	3915.4319	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2983.5266	26.0600	777.5070	(240)
Space heating - main system 2	0.0000	26.0600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	26.0600	200.6978	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	26.0600	181.6706	(249)
Energy for lighting	244.9569	26.0600	63.8358	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	26.0600	-203.3497	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-203.3497	(252)
Total energy cost			1020.3616	(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	2983.5266	0.1565	466.9399	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			575.6776	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	0.1341	-104.6354	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-104.6354	(269)
Total CO2, kg/year			603.0967	(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	2983.5266	1.5794	4712.2440	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			5884.4652	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	244.9569	1.5338	375.7231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	1.4956	-1167.0059	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1167.0059	(283)
Total Primary energy kWh/year			6147.7921	(286)

SAP 10 EPC IMPROVEMENTS

Be Green

Current energy efficiency rating: C 72
Current environmental impact rating: A 94

N Solar water heating	SAP increase too small
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable

Recommended measures:	SAP change	Cost change	CO2 change
(none)			
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.6	-£ 35	-16 kg (2.7%)

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

Potential energy efficiency rating: C 72
Potential environmental impact rating: A 94

Fuel prices for cost data on this page from database revision number 551 TEST (31 Jul 2024)

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	£1224	£1224	£0
Space heating	£959	£959	£0
Water heating	£201	£201	£0
Lighting	£64	£64	£0
Generated (PV)	-£203	-£203	£0
Total cost of fuels	£1021	£1021	£0
Total cost of uses	£1021	£1021	£0
Delivered energy	33 kWh/m²	33 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	5 kg/m²	5 kg/m²	0 kg/m²
Primary energy	52 kWh/m²	52 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	22.7500	(1b)	x 3.0000	(2b) =	68.2500	(1b) - (3b)
First floor	51.1900	(1c)	x 2.5000	(2c) =	127.9750	(1c) - (3c)
Second floor	43.2900	(1d)	x 2.9500	(2d) =	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	117.2300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		323.9305	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		77.4000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3489	0.3443	0.3396	0.3165	0.3119	0.2888	0.2888	0.2841	0.2980	0.3119	0.3211	0.3304	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000	(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000	70.0000	1531.6000	(32)
Party Wall Floor 2			14.4300	0.0000	0.0000	70.0000	1010.1000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)

Internal Floor 1	22.7500	18.0000	409.5000 (32d)
Internal Ceiling Ground	22.7500	9.0000	204.7500 (32e)
Internal Ceiling Floor 1	51.1900	9.0000	460.7100 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 27713.4700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 236.4025 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	22.7000	0.1600	3.6320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13	Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14	Flat roof	2.7000	0.1000	0.2700
E16	Corner (normal)	20.9000	0.1000	2.0900
E18	Party wall between dwellings	8.9000	0.0600	0.5340
E20	Exposed floor (normal)	9.7000	0.2000	1.9400
E21	Exposed floor (inverted)	6.2000	0.2000	1.2400
E25	Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2	Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025
P8	Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500
R1	Head of roof window	1.6000	0.1000	0.1600
R2	Sill of roof window	1.6000	0.0800	0.1280
R3	Jamb of roof window	3.2000	0.1000	0.3200
R4	Ridge (vaulted ceiling)	7.4000	0.1000	0.7400
P5	Party Wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.1440 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.9999 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2937	36.7993	36.3049	33.8329	33.3385	30.8665	30.8665	30.3721	31.8553	33.3385	34.3273	35.3161	(38)
Heat transfer coeff	116.2937	115.7993	115.3049	112.8329	112.3385	109.8665	109.8665	109.3721	110.8553	112.3385	113.3273	114.3161	(39)

Average = Sum(39)m / 12 = 112.7093

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9920	0.9878	0.9836	0.9625	0.9583	0.9372	0.9372	0.9330	0.9456	0.9583	0.9667	0.9751	(40)
HLP (average)												0.9614	
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 2.8519 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)
Hot water usage for baths	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)
Hot water usage for other uses	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)

Average daily hot water use (litres/day) 135.1040 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2592.9170	(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	77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	34.6762	30.7991	25.0475	18.9626	14.1747	11.9669	12.9307	16.8078	22.5594	28.6443	33.4321	35.6399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)

Total internal gains
670.9491 668.7486 646.8375 606.0262 564.7659 527.5476 505.5131 508.7112 529.7685 567.2984 612.4805 651.9219 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	19.6403	0.5000	0.7000	0.7700	21.6274	(76)
West	4.6500	19.6403	0.5000	0.7000	0.7700	22.1514	(80)
West	9.5000	19.6403	0.5000	0.7000	0.7700	45.2556	(80)
North	1.2800	16.1759	0.5600	0.7000	1.0000	7.3048	(82)

Solar gains 96.3392 188.0044 311.9885 464.0677 580.1997 599.8152 568.5801 480.1251 365.3282 223.3917 119.9569 79.3778 (83)
Total gains 767.2883 856.7530 958.8260 1070.0938 1144.9656 1127.3628 1074.0932 988.8364 895.0967 790.6901 732.4374 731.2997 (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	66.1961	66.4787	66.7638	68.2264	68.5267	70.0686	70.0686	70.3853	69.4436	68.5267	67.9288	67.3412	
alpha	5.4131	5.4319	5.4509	5.5484	5.5684	5.6712	5.6712	5.6924	5.6296	5.5684	5.5286	5.4894	
util living area	0.9960	0.9920	0.9788	0.9298	0.8064	0.6068	0.4474	0.5034	0.7753	0.9602	0.9922	0.9969	(86)
MIT	19.8397	19.9998	20.2763	20.6331	20.8796	20.9811	20.9971	20.9947	20.9295	20.5943	20.1599	19.8224	(87)
Th 2	20.0900	20.0935	20.0970	20.1147	20.1183	20.1360	20.1360	20.1396	20.1289	20.1183	20.1112	20.1041	(88)
util rest of house	0.9948	0.9896	0.9722	0.9086	0.7567	0.5319	0.3610	0.4120	0.7040	0.9437	0.9894	0.9960	(89)
MIT 2	19.0330	19.1948	19.4698	19.8243	20.0396	20.1274	20.1352	20.1380	20.0909	19.7979	19.3688	19.0270	(90)
Living area fraction										fLA = Living area / (4) =		0.3290	(91)
MIT	19.2984	19.4596	19.7352	20.0904	20.3159	20.4083	20.4188	20.4199	20.3668	20.0599	19.6291	19.2887	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.5984	19.7596	20.0352	20.3904	20.6159	20.7083	20.7188	20.7199	20.6668	20.3599	19.9291	19.5887	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9940	0.9885	0.9717	0.9158	0.7858	0.5822	0.4195	0.4741	0.7497	0.9489	0.9887	0.9953	(94)
Useful gains	762.6672	846.9023	931.6730	980.0388	899.7618	656.2993	450.5668	468.7601	671.0424	750.2541	724.1346	727.8359	(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	1779.1059	1720.7365	1560.6718	1296.4959	1001.6015	671.0969	452.5186	472.4712	727.9655	1096.4118	1453.8836	1759.1732	(97)
Space heating kWh	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98a)
Space heating requirement - total per year (kWh/year)												3665.3154	
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	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3665.3154	
Space heating per m2											(98c) / (4) =	31.2660	(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)
Fraction of main heating from main system 2 0.0000 (203)
Fraction of total heating from main system 1 1.0000 (204)
Fraction of total heating from main system 2 0.0000 (205)
Efficiency of main space heating system 1 (in %) 100.0000 (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	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	756.2304	587.2165	467.9751	227.8491	75.7687	0.0000	0.0000	0.0000	0.0000	257.5414	525.4193	767.3149	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-28.1644	-43.8500	-68.5465	-81.1330	-88.0877	-80.1563	-79.2174	-72.4040	-60.9858	-51.0721	-32.1118	-23.8955	(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	3665.3154	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-709.6246	(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	4667.9095	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3665.3154	16.4900	604.4105	(240)
Space heating - main system 2	0.0000	16.4900	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	16.4900	126.9957	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	16.4900	114.9558	(249)
Energy for lighting	244.9569	16.4900	40.3934	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-709.6246	16.4900	-117.0171	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-117.0171	(252)
Total energy cost			769.7383	(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] =	1.7081	(257)
SAP value		72.3116	
SAP rating (Section 12)		72	(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	3665.3154	0.1557	570.8406	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			679.5782	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-709.6246	0.1338	-94.9751	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-94.9751	(269)
Total CO2, kg/year			716.6578	(272)
CO2 emissions per m2			6.1100	(273)
EI value			94.0805	
EI rating			94	(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)	
Ground floor	22.7500 (1b)	x	3.0000 (2b)	=	68.2500	(1b) - (3b)
First floor	51.1900 (1c)	x	2.5000 (2c)	=	127.9750	(1c) - (3c)
Second floor	43.2900 (1d)	x	2.9500 (2d)	=	127.7055	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 117.2300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	323.9305	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000	(22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750	(22a)
Adj infilt rate	0.2359	0.2174	0.2128	0.1989	0.1989	0.1850	0.1850	0.1804	0.1850	0.2081	0.2035	0.2174	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation	0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)	0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	77.4000 (23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3489	0.3304	0.3257	0.3119	0.3119	0.2980	0.2980	0.2934	0.2980	0.3211	0.3165	0.3304	(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	
Window (Uw = 1.30)			9.1900	1.2357	11.3565			(27)
Glazed Door (Uw = 1.30)			9.5000	1.2357	11.7395			(27)
Roof Windows F2			1.2800	1.2357	1.5817			(27a)
Ground Floor			42.9000	0.1200	5.1480	110.0000	4719.0000	(28a)
Exposed Floor Garage			20.1500	0.1126	2.2683			(28b)
Exposed Floor Overhang			8.2900	0.1200	0.9948			(28b)
External Wall Ground Floor	49.5000	2.4600	47.0400	0.1500	7.0560	60.0000	2822.4000	(29a)
Garage Wall	18.6000		18.6000	0.1400	2.6040	150.0000	2790.0000	(29a)
External Wall Floor 1	51.1300	4.2100	46.9200	0.1500	7.0380	150.0000	7038.0000	(29a)
External Wall Floor 2	48.9500	12.0200	36.9300	0.1500	5.5395	150.0000	5539.5000	(29a)
External Roof	47.3600	1.2800	46.0800	0.1200	5.5296	9.0000	414.7200	(30)
Total net area of external elements Aum(A, m2)			286.8800					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.8559			(33)
Party Wall Floor 1			21.8800	0.0000	0.0000	70.0000	1531.6000	(32)
Party Wall Floor 2			14.4300	0.0000	0.0000	70.0000	1010.1000	(32)
Internal Wall Ground Floor			20.2500			9.0000	182.2500	(32c)
Internal Wall Floor 1			46.6300			9.0000	419.6700	(32c)
Internal Wall Floor 2			19.0300			9.0000	171.2700	(32c)
Internal Floor 1			22.7500			18.0000	409.5000	(32d)
Internal Ceiling Ground			22.7500			9.0000	204.7500	(32e)
Internal Ceiling Floor 1			51.1900			9.0000	460.7100	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 27713.4700	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	236.4025	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E1	Steel lintel with perforated steel base plate	13.4400	0.0500	0.6720
E3	Sill	10.7300	0.0500	0.5365
E4	Jamb	13.4600	0.0500	0.6730
E5	Ground floor (normal)	22.7000	0.1600	3.6320
E6	Intermediate floor within a dwelling	28.6000	0.0000	0.0000
E8	Balcony within a dwelling, wall insulation continuous	9.6000	0.0600	0.5760
E13	Gable (insulation at rafter level)	14.3200	0.1000	1.4320
E14	Flat roof	2.7000	0.1000	0.2700
E16	Corner (normal)	20.9000	0.1000	2.0900
E18	Party wall between dwellings	8.9000	0.0600	0.5340
E20	Exposed floor (normal)	9.7000	0.2000	1.9400
E21	Exposed floor (inverted)	6.2000	0.2000	1.2400
E25	Staggered party wall between dwellings	6.0000	0.0600	0.3600
P2	Party wall - Intermediate floor within a dwelling	7.4000	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	1.3500	0.1500	0.2025
P8	Party Wall - Exposed floor (inverted)	8.7500	0.2000	1.7500
R1	Head of roof window	1.6000	0.1000	0.1600
R2	Sill of roof window	1.6000	0.0800	0.1280
R3	Jamb of roof window	3.2000	0.1000	0.3200
R4	Ridge (vaulted ceiling)	7.4000	0.1000	0.7400
P5	Party wall - Roof (insulation at rafter level)	7.4000	0.1200	0.8880

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	18.1440	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 78.9999	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.2937	35.3161	34.8217	33.3385	33.3385	31.8553	31.8553	31.3609	31.8553	34.3273	33.8329	35.3161	(38)

Heat transfer coeff

	116.2937	114.3161	113.8217	112.3385	112.3385	110.8553	110.8553	110.3609	110.8553	113.3273	112.8329	114.3161 (39)
Average = Sum(39)m / 12 =												112.7093

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9920	0.9751	0.9709	0.9583	0.9583	0.9456	0.9456	0.9414	0.9456	0.9667	0.9625	0.9751	(40)
HLP (average)												0.9614	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8519	(42)
Hot water usage for mixer showers													
	72.0376	70.9550	69.3774	66.3591	64.1317	61.6476	60.2357	61.8013	63.5175	66.1846	69.2677	71.7616	(42a)
Hot water usage for baths													
	31.1017	30.6398	29.9894	28.7900	27.8920	26.8962	26.3583	27.0042	27.7075	28.7730	29.9971	30.9966	(42b)
Hot water usage for other uses													
	43.8368	42.2427	40.6486	39.0546	37.4605	35.8664	35.8664	37.4605	39.0546	40.6486	42.2427	43.8368	(42c)
Average daily hot water use (litres/day)												135.1040	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	146.9761	143.8375	140.0155	134.2037	129.4842	124.4103	122.4605	126.2660	130.2796	135.6063	141.5075	146.5949	(44)
Energy conte	232.7742	204.8227	215.1985	183.7182	174.3106	152.9770	148.1053	156.3437	160.6477	184.0164	201.6034	229.5322	(45)
Energy content (annual)										Total = Sum(45)m =		2244.0500	
Distribution loss (46)m = 0.15 x (45)m													
	34.9161	30.7234	32.2798	27.5577	26.1466	22.9465	22.2158	23.4516	24.0972	27.6025	30.2405	34.4298	(46)
Water storage loss:													
Store volume												269.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7700	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9558	(55)
Total storage loss													
	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(56)
If cylinder contains dedicated solar storage													
	29.6298	26.7624	29.6298	28.6740	29.6298	28.6740	29.6298	29.6298	28.6740	29.6298	28.6740	29.6298	(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													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
										Total per year (kWh/year) = Sum(64)m =		2592.9170	(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													
	77.3974	68.1035	71.5535	61.0863	57.9583	50.8648	49.2450	51.9843	53.4154	61.1855	67.0331	76.3195	(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	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	171.1167	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	34.6762	30.7991	25.0475	18.9626	14.1747	11.9669	12.9307	16.8078	22.5594	28.6443	33.4321	35.6399	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	420.2417	424.6024	413.6134	390.2190	360.6877	332.9326	314.3904	310.0296	321.0186	344.4130	373.9443	401.6995	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	54.9636	(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)													
	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	-114.0778	(71)
Water heating gains (Table 5)													
	104.0288	101.3446	96.1741	84.8421	77.9009	70.6456	66.1895	69.8714	74.1880	82.2385	93.1016	102.5799	(72)
Total internal gains													
	670.9491	668.7486	646.8375	606.0262	564.7659	527.5476	505.5131	508.7112	529.7685	567.2984	612.4805	651.9219	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	4.5400	25.9136	0.5000	0.7000	0.7700	28.5355	(76)
West	4.6500	25.9136	0.5000	0.7000	0.7700	29.2269	(80)
West	9.5000	25.9136	0.5000	0.7000	0.7700	59.7109	(80)
North	1.2800	20.9127	0.5600	0.7000	1.0000	9.4438	(82)

Solar gains	126.9171	211.9569	349.6351	527.9004	628.5312	702.2264	650.1207	562.0819	433.6356	266.3907	156.6707	99.7905	(83)
Total gains	797.8662	880.7056	996.4726	1133.9266	1193.2971	1229.7740	1155.6338	1070.7931	963.4042	833.6890	769.1512	751.7123	(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	66.1961	67.3412	67.6337	68.5267	68.5267	69.4436	69.4436	69.7547	69.4436	67.9288	68.2264	67.3412	
alpha	5.4131	5.4894	5.5089	5.5684	5.5684	5.6296	5.6296	5.6503	5.6296	5.5286	5.5484	5.4894	
util living area	0.9934	0.9884	0.9676	0.8943	0.7338	0.4994	0.3543	0.3803	0.6614	0.9242	0.9845	0.9948	(86)
MIT	19.9936	20.1316	20.4113	20.7356	20.9326	20.9934	20.9992	20.9989	20.9722	20.7306	20.3416	19.9878	(87)

Th 2	20.0900	20.1041	20.1076	20.1183	20.1183	20.1289	20.1289	20.1324	20.1289	20.1112	20.1147	20.1041	(88)
util rest of house	0.9913	0.9847	0.9575	0.8647	0.6741	0.4243	0.2712	0.2917	0.5774	0.8935	0.9787	0.9931	(89)
MIT 2	19.1862	19.3338	19.6094	19.9188	20.0784	20.1264	20.1287	20.1322	20.1166	19.9161	19.5508	19.1918	(90)
Living area fraction									fLA = Living area / (4) =			0.3290	(91)
MIT	19.4519	19.5963	19.8732	20.1875	20.3595	20.4117	20.4151	20.4174	20.3981	20.1841	19.8110	19.4537	(92)
Temperature adjustment												0.3000	
adjusted MIT	19.7519	19.8963	20.1732	20.4875	20.6595	20.7117	20.7151	20.7174	20.6981	20.4841	20.1110	19.7537	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9903	0.9837	0.9584	0.8779	0.7117	0.4748	0.3272	0.3516	0.6333	0.9076	0.9786	0.9922	(94)
Useful gains	790.1336	866.3779	954.9871	995.4942	849.2932	583.9323	378.1108	376.4732	610.1506	756.6915	752.7128	745.8793	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1669.0296	1622.8644	1465.2532	1223.0873	905.3864	588.8272	378.5869	377.1457	631.6658	984.1435	1321.3880	1629.4279	(97)
Space heating kWh	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98a)
Space heating requirement - total per year (kWh/year)												2983.5266	
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	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2983.5266	
Space heating per m2											(98c) / (4) =	25.4502	(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)
Fraction of main heating from main system 2												0.0000	(203)
Fraction of total heating from main system 1												1.0000	(204)
Fraction of total heating from main system 2												0.0000	(205)
Efficiency of main space heating system 1 (in %)												100.0000	(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	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	653.8987	508.3590	379.6380	163.8670	41.7334	0.0000	0.0000	0.0000	0.0000	169.2243	409.4461	657.3602	(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)
Space heating fuel used, main system 2												0.0000	(213)
Water heating													
Water heating requirement	262.4040	231.5851	244.8283	212.3922	203.9404	181.6510	177.7351	185.9735	189.3217	213.6462	230.2774	259.1620	(64)
Efficiency of water heater												336.6824	(216)
(217)m	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	336.6824	(217)
Fuel for water heating, kWh/month	77.9381	68.7844	72.7179	63.0839	60.5735	53.9532	52.7902	55.2371	56.2316	63.4563	68.3960	76.9752	(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	59.2078	53.4780	59.2078	57.2979	59.2078	57.2979	59.2078	59.2078	57.2979	59.2078	57.2979	59.2078	(231)
Lighting	30.3519	24.3494	21.9239	16.0624	12.4071	10.1367	11.3181	14.7117	19.1091	25.0722	28.3190	31.1954	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.3469	-47.4781	-73.0680	-86.4518	-90.4851	-88.3630	-85.9754	-79.9259	-68.2035	-56.7334	-39.4803	-28.8019	(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	2983.5266	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	336.6824	
Water heating fuel used	770.1375	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.7640)		
mechanical ventilation fans (SFP = 1.7640)	697.1244	(230a)
Total electricity for the above, kWh/year	697.1244	(231)
Electricity for lighting (calculated in Appendix L)	244.9569	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-780.3134	(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	3915.4319	(238)

10a. Fuel costs - using BEDF prices (551)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2983.5266	26.0600	777.5070	(240)
Space heating - main system 2	0.0000	26.0600	0.0000	(241)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	26.0600	200.6978	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	697.1244	26.0600	181.6706	(249)
Energy for lighting	244.9569	26.0600	63.8358	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	26.0600	-203.3497	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-203.3497	(252)
Total energy cost			1020.3616	(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	2983.5266	0.1565	466.9399	(261)
Space heating - main system 2	0.0000	0.0000	0.0000	(262)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	770.1375	0.1412	108.7377	(264)
Space and water heating			575.6776	(265)
Pumps, fans and electric keep-hot	697.1244	0.1387	96.6997	(267)
Energy for lighting	244.9569	0.1443	35.3548	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	0.1341	-104.6354	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-104.6354	(269)
Total CO2, kg/year			603.0967	(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	2983.5266	1.5794	4712.2440	(275)
Space heating - main system 2	0.0000	0.0000	0.0000	(276)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	770.1375	1.5221	1172.2212	(278)
Space and water heating			5884.4652	(279)
Pumps, fans and electric keep-hot	697.1244	1.5128	1054.6097	(281)
Energy for lighting	244.9569	1.5338	375.7231	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-780.3134	1.4956	-1167.0059	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1167.0059	(283)
Total Primary energy kWh/year			6147.7921	(286)