



WHITECODE
CONSULTING

Energy Strategy

Former Friends School Fields

Prepared for Chase New Homes

12084-WCL-ZZ-ZZ-RP-Y-0001

Rev 02

April 2025

Executive Summary

This energy strategy has been prepared by Whitecode Consulting to accompany an application for planning permission for the former Friends School Fields site. The planning application is submitted on behalf of Case Ne Homes. It is complete in line with energy requirements for the site and the Uttlesford Borough Local Plan 2005.

The site description is as follows:

Er tio of 75 . d llings wi associated fra ructure and andscapin rovisio of p y g ields a d associated clubhouse.

The residential elements have been assessed against Part L A 2021 of the Building Regulations using the Standard Assessment Procedure (SAP) 10. methodology. The non-residential elements have been assessed under Part 2A 2021 of the Building Regulations using DEMM methodology and ES software. The strategy outlines the proposed energy strategy for the site following the energy hierarchy: Be Lean – Be Clean – Be Green.

Energy efficiency is the first stage of the energy hierarchy. Energy demand should be reduced as far as possible before the heating strategy and installation of low carbon and renewable technologies is considered. This is important in protecting consumers from high prices.

This report concludes that the proposed residential development will achieve a 67% improvement over Part L 2021 of the Building Regulations and the commercial development will achieve 43% improvement. Overall, the proposed development will achieve a 66% improvement over Part L 2021 of the Building Regulations (site-wide).



- **Be Lean** – improved building fabric specification to exceed that of the notional building, low air permeability target, thermal bridging details and selection of energy efficient services.

- **Be Clean** – connection to a district heat network and installation of Combined Heat and Power (CHP) have been investigated for the site and not been deemed either available or appropriate at this time.

- **Be Green** – Highly efficient air source heat pumps are to be installed, as well as photovoltaic panels

- The scheme is designed to meet the requirements of the more onerous 'option 1' of the Future Homes Standard which is currently in consultation but recommends ASHP and PV panels for each dwelling.

This report concludes that the proposed development will achieve a **66% improvement** over Part L 2021 of the Building Regulations.

The following tables demonstrate the overall reduction in regulated carbon emissions of the development after each stage of the energy hierarchy.

	Carbon dioxide emissions for domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	94.8
After energy demand reduction (be lean)	94.7
After heat network/CHP (be clean)	94.7
After renewable energy (be green)	31.7

Table 1: Carbon emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.2	0%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	62.9	66%
Cumulative on-site savings	63.1	67%

Table 2: Regulated carbon savings after each stage of the energy hierarchy for domestic buildings

	Carbon dioxide emissions for non-domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	1.7
After energy demand reduction (be lean)	2.2
After heat network/CHP (be clean)	2.2
After renewable energy (be green)	1.0

Table 3: Carbon emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	-0.4	-25%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	1.2	68%
Cumulative on-site savings	0.7	43%

Table 4: Regulated carbon savings after each stage of the energy hierarchy for non-domestic buildings

	Total regulated emissions (tonnes CO ₂ /year)	CO ₂ /year (tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	96.6		
Be lean	96.8	-0.3	0%
Be clean	96.8	0.0	0%
Be green	32.7	64.1	66%
Total savings		63.8	66%

Table 5: Site wide carbon savings

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Revisions:

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01	24/06/2024	First Issue	EH	BT
02	04/04/2025	Update to unit numbers	MG	EH

1. Introduction

The purpose of this report is to show how the client can address the relevant energy condition for the proposed development located at Former Friends School Fields. These conditions are highlighted below.

1.1. National Planning Policy and Targets

The proposed development will be constructed in compliance with Part L 2013 of the Building Regulations. The proposed development consists of new build dwelling, under Part L A 2013 of the Building Regulations, and the clubhouse under Part L A 2013. This mandates that the design of the building demonstrates a low carbon dioxide (CO₂) emissions threshold in a notation equivalent to the given specifications.

The National Planning Policy Framework (NPPF) was updated in December 2024, which re-emphasises the Government's commitment to sustainable development and states the need for planning authorities to take an approach based on integrating the four aims of sustainable development. The document also refers to the Government's energy policies and objectives and sets out the principles that regional planning bodies and local planning authorities should adhere to in their approach to planning for renewable energy.

1.2. Local Planning Policies

The proposed development lies in the borough of Uttlesford, therefore, the applicable Local Planning Policy is the title for Local Plan 2015. **The emerging Local Plan has been submitted to PINs for examination and the Uttlesford Design Code is adopted.**

The Uttlesford Local Plan 2015, sets out long-term energy and sustainability related standards for the Borough as follows:

- Policy GEN 2 – Design
- Policy ENV 15 – Renewable Energy

Energy use should be prioritised in line with the Energy Hierarchy. The first priority is to be lean. This is to ensure less overall energy use with good building design and high energy efficiency using passive design measures, such as building orientation, internal and external building layout, tree planting (prioritising endemic and deciduous species) and the size and location of windows.

The second priority is to be clean; to use energy that is supplied efficiently. Developments should consider connecting to decentralised energy networks (energy generated off the energy grid). This can include technologies such as solar energy and water, heat pumps, biomass-fuelled energy generation and larger-scale schemes, such as Combined Heat and Power (CHP) systems.

The final priority is to be green and use renewable low or zero carbon energy sources. To reduce the impact on the environment and contribute towards the borough becoming carbon neutral, energy generation using sustainable sources is strongly encouraged.

The other policies that set out the sustainability standards are explored in our separate sustainability statement.

1.3. The Development

Erection of 75 no. dwellings with associated infrastructure and landscaping. Provision of playing field and associated clubhouse.

A sample of dwellings has been modelled using the Standard Assessment Procedure (SAP) 10.2 methodology.

The Clubhouse has been assessed and has been modelled against L2A 2021 (DSM) using IES Virtual Environment (v2023).

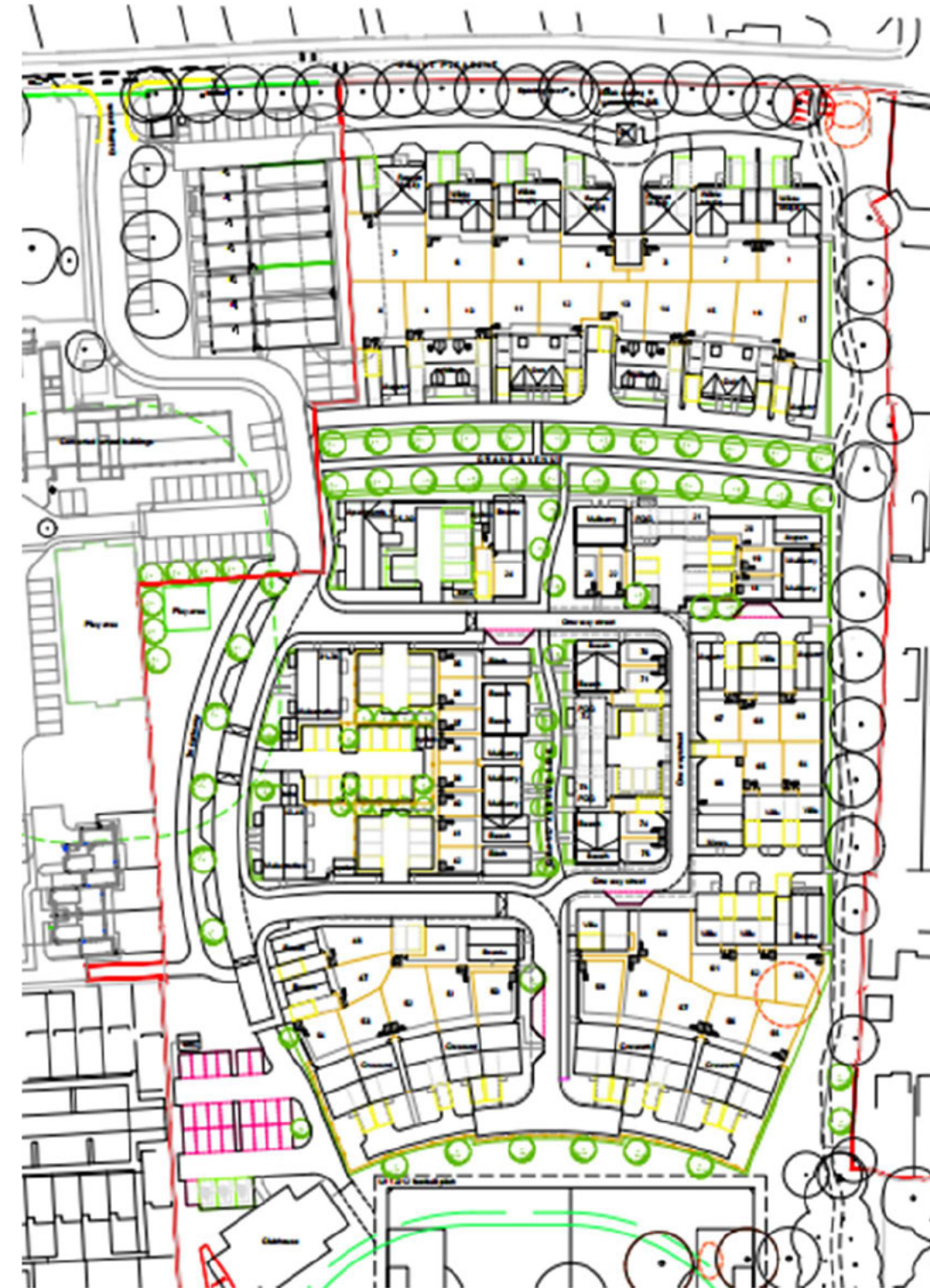


Figure 1.1 Proposed Site Plan

2. Baseline Energy Consumption & Carbon Emissions

An assessment of the site's potential energy use was conducted in compliance with the minimum requirements of Part L1 2021 of the Building Regulations.

The energy assessment must first establish the regulated CO₂ emissions baseline assuming the development complied with Part L 2021 of the Building Regulations using Building Regulations approved compliance software.

Regulated energy is calculated as follows:

Dwellings: Dwelling CO₂ Emissions Rates (DER) has been calculated through the Part L 2021 of the Building Regulations methodology SAP 10.2. A representative sample of dwellings has been selected to model covering all unit types, orientations and floor levels.

Non-residential: A building CO₂ Emissions Rate (BER) has been calculated through Part L 2021 of the Building Regulations methodology based on the National Calculation Methodology (NCM) and implemented through Dynamic Simulation Modelling (DSM) v7.0.21

To determine the CO₂ emissions baseline, the Target Emission Rate (TER) from the Be Lean model is used.

Approved Document L1A also includes the fabric energy efficiency (FEE) which is a measure of the amount of energy which would normally be needed to maintain comfortable internal temperatures and can be influenced by fabric U-values, thermal bridging, air permeability and thermal mass.

Fabric Energy Efficiency	kWh/m ²
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	38.50

Table 2.2 Target fabric energy efficiency

Regulated carbon dioxide emissions (tonnes CO ₂ per annum)	Domestic	Non-domestic
Baseline: Part L 2021 of the Building Regulations compliant development	94.8	1.7

Table 2.1 Baseline carbon emissions

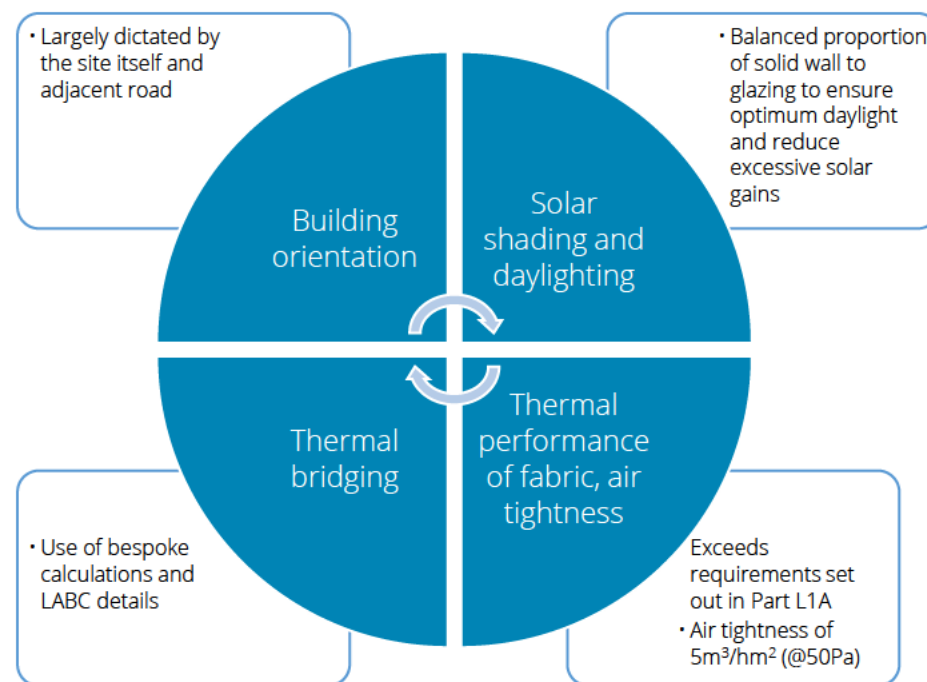
3. 'Be Lean' – Energy efficient design

An assessment of the site's potential energy use was conducted in compliance with the minimum requirements of Part L1A 2021 of the Building Regulations.

Local planning guidelines require a reduction in the CO2 emissions of the proposed scheme by energy-efficient measures. A number of energy-efficient measures are considered below.

3.1. Passive Design Measures

Passive design measures involve adapting building massing, layout and glazing to best respond to the local climate and annual sun path in order to reduce energy demands.



The table below shows the proposed building fabric against Part L of the Building Regulations. Approximately 50% of heat is lost through the fabric of a building. This includes walls, floors, windows, roofs and the thermal bridging connecting them. The remaining 50% is lost through uncontrolled ventilation through gaps around doors, windows, and any service penetrations.

Element:	Part L 2021 Limiting Values:	Domestic design	Non-domestic design
Floors	0.25 W/m ² K	0.12 W/m ² K	0.12 W/m ² K
External Walls	0.30 W/m ² K	0.17 W/m ² K	0.18 W/m ² K
Common Area Walls (unheated space)	0.30 W/m ² K	0.20 W/m ² K	N/A
Party Walls (between dwellings)	0.20 W/m ² K	0.00 W/m ² K	N/A
Roofs	0.20 W/m ² K	0.12 W/m ² K	N/A
Front Doors	2.00 W/m ² K	1.20 W/m ² K	N/A
Windows	2.00 W/m ² K	1.20 W/m ² K	1.60 W/m ² K
Window g-value	N/A	0.72	0.40
Air Permeability Rate	10m ³ /hm ² (@50Pa)	5 m ³ /hm ² (@50Pa)	3m ³ /hm ² (@50Pa)

Table 3.1 Proposed U-values

A thermal bridge, also called a cold bridge, is an area of building construction which has a significantly higher heat transfer than the surrounding materials. This is typically where there is either a break in the insulation, less insulation or the insulation is penetrated by an element with a higher thermal conductivity. Where the building is situated in a cold climate (such as the UK) this can result in additional heat loss at these points.

Around 30% of the total heat loss through a building's fabric can be caused by thermal bridging. Indications are that better detailing and improved air tightness can reduce a dwelling's annual CO2 emissions by up to 10%.

This development will use a range of recognised details for the psi values, based on a brick and block construction.

3.2. Active design measures

After addressing the passive design measures the next step is to use energy-efficient building services, lighting, and controls throughout the scheme to reduce fuel consumption.

Space heating and hot water

- Air Source Heat Pumps (ASHPs) will provide heating and hot water to the dwellings.
- Houses - Monobloc ASHP
- Apartments - Exhaust Air Source Heat Pumps (EAHP)

Ventilation

- The dwellings will be provided with mechanical extract ventilation
- The clubhouse will have mechanical extract SFP 1.6

Building services insulation

- All building services, tanks, pipes and ducts will be insulated to a high standard.

Lighting

- Internal lighting has a significant impact on the Dwelling Emission Rate (DER). Therefore, it is recommended that 100% of all internal light fittings will be low energy in order to reduce CO₂ emissions and the overall energy used (typical tungsten bulbs can use up to 300% more energy).
- Lighting in residential has assumed to be LED / CFL (Lm/W = 80)
- Commercial lighting minimum 100lm/cW efficiency
- Daylighting controls - Dimming/standalone
- Occupancy controls - Auto-On-Off

3.3. 'Be Lean' Results

A sample of SAP calculations has been carried out for the proposed development using the 'Be Lean' specification. A Dynamic Simulation Model (DSM) for the non-domestic parts have also been completed. Using the notional building system type and performance values specified in the Part L 2021 baseline as determined by the final proposed building specification.

Regulated carbon dioxide emissions (tonnes CO ₂ per annum)	Domestic tonnes CO ₂ per annum	Non-domestic tonnes CO ₂ per annum
Baseline: Part L 2021 of the Building Regulations compliant development	94.8	1.7
After energy demand reduction (be lean)	94.7	2.2
Carbon savings over baseline	0.1	-0.4
Carbon reduction over baseline	0%	-25%

The reduction in fabric energy efficiency is 11% as the following table demonstrates:

Fabric energy efficiency	(kWh/m ² per annum)
Part L1A Target Fabric Energy Efficiency Rate (TFEE)	38.5
Dwelling Fabric Efficiency (DFEE)	34.2
Reduction over TFEE	11%

Table 3.2 Fabric energy efficiency

4. Cooling due to potential summer overheating

4.1. Cooling hierarchy

The cooling hierarchy has been followed in order to reduce the demand for cooling. The following categories have been considered:

1. [Minimising internal heat generation through energy efficient design](#) – minimised heat distribution infrastructure within the buildings.
2. [Reducing the amount of heat entering the building during summer](#) – the location, proportion and specification of the glazing should aim to balance natural light and 'beneficial' solar gain whilst ensuring that levels of heat gain are not excessive.
3. [Use of thermal mass and high ceilings to manage heat within the building](#) – higher thermal mass construction enables heat to be absorbed in the day and then released at night, however, a balance must be struck. Lightweight structures without the energy-absorption potential are often at risk of overheating.
4. [Passive ventilation](#) – providing openable windows to allow natural ventilation and night-time cooling to comply with Part F of the Building Regulations. Low-temperature air from external is allowed into the building during the night and circulates throughout the building cooling the building fabric.
5. [Mechanical ventilation](#) - this can be used to make use of free cooling when the outside air temperature is below that in the building during summer months, through the use of a summer by-pass on the MVHR.

5. 'Be Clean' – Heating Infrastructure

5.1. District Heating – Connection to existing scheme

The site has been investigated for connection to an existing or proposed heat network, in line with the heating hierarchy.

There are no local heat networks in the area for connection.

Due to the lack of an available network nearby connection to an existing district heating network was deemed unfeasible.

Instead of this, highly efficient Air Source Heat Pumps (ASHPs) are proposed for the heating and hot water for the building. This is explored in the 'Be Green' section.

5.2. 'Be Clean' Results

Since there are no changes proposed, the 'be clean' results are identical to those at the end of the 'be lean' stage.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Domestic	Non-domestic
Baseline: Part L 2021 of the Building Regulations compliant development	94.8	1.7
After energy demand reduction (be lean)	94.7	2.2
After heat network/CHP (be clean)	94.7	2.2
% reduction at this stage	0	0

6. 'Be Green' – Renewable Energy

6.1. Heat Pumps

Heat pumps collect low-temperature heat from renewable sources and “concentrate” it to a usable temperature. Grid electricity is generally required to operate the pumps and the renewable component of the output is therefore by convention taken as the difference between the output energy and the input energy.

With the decarbonisation of the grid, the carbon factor associated with electricity is much lower, as we rely more heavily on renewable sources such as wind power, over fossil-fuel-fired power stations. This makes heat pumps a low-carbon energy source.

A typical heat pump will deliver 4-5 kWh of useful energy for every 1 kWh of input energy. A heat pump operating in this way can therefore be deemed to have delivered 3-4 kWh of renewable energy.

Air source heat pumps have been identified as the most appropriate technology for the heating and hot water for the site. The houses will be provided with external monobloc air source heat pumps, and the apartments will have exhaust air source heat pumps.

6.2. Photovoltaic Panels

Photovoltaic (PV) systems convert energy from the sun into electricity via semiconductor cells. There are a wide range of different panels available on the market, from less expensive amorphous silicon with low efficiencies to mono-crystalline silicon with much higher efficiencies (1kWp requires around 6m² of free roof area).

Ideally, PV panels need to be positioned within 30° South and at an angle of 30° to achieve optimum performance. It is essential PV panels are unshaded, as even a small amount of shading dramatically reduces the output of the panel.

In order to future-proof the scheme for the more onerous 'Future Homes Standard', photovoltaic panels have been provided for each dwelling. This has been calculated based on 40% of the ground floor area as per the consultation document.

The kWp PV included in the calculations is as follows:

	kWp
Aspen	3.47
Beech	3.05
Willow	3.53
Bronte	5.11
Crescent	4.10
Rowan	4.84
Wilde	6.01
Apartments (per unit)	2.20
Villa	4.10
Mulberry	3.05
Maisonettes	2.20

There is also PV provided to the Clubhouse, totalling 10kWp.

6.3. 'Be Green' Results

A sample of SAP calculations for the dwellings and DSM for the non-domestic areas have been completed using the 'Be Green' specification of air source heat pumps and PV to the dwellings.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Domestic	Non-domestic
Baseline: Part L 2021 of the Building Regulations compliant development	94.8	1.7
After energy demand reduction (be lean)	94.7	2.2
After heat network/CHP (be clean)	94.7	2.2
After renewable energy (be green)	31.7	1.0
% carbon reduction	67%	43%
% carbon reduction site wide	66%	

Table 6.1 Sitewide carbon savings

7. Conclusion

This energy strategy outlines the key features and strategies adopted by the design team to reduce energy use and carbon emissions for the scheme. It demonstrates compliance with the building regulations Part L1A and L2A, as well as the Uttlesford Local Plan.

The strategy for reducing energy and associated carbon emissions follows the energy hierarchy:

- **Be Lean** – improved building fabric specification to exceed that of the notional building, low air permeability target, thermal bridging details and selection of energy efficient services
- **Be Clean** – connection to a district heat network and installation of Combined Heat and Power (CHP) have been investigated for the site and have not been deemed either available or appropriate at this time.
- **Be Green** – Highly efficient air source heat pumps and photovoltaic panels are to be installed to service the scheme.

This report concludes that the proposed development at Former Friends School Field will achieve a 66% improvement over Part L1A 2021 of the Building Regulations.

The final specification to meet the 66% carbon reduction on site is as follows:

	Specification	
	Domestic	Non- domestic
Heating	Air source heat pump (houses) Exhaust air source heat pump (apartments)	Air source heat pump (COP 3.24) and direct electric
Hot water	As above	From ASHP
Emitter	Radiators	Underfloor heating
Ventilation	Natural ventilation & extract (houses) MEV (apartments)	MVHR (80% efficient)
Lighting	100% low energy 80lm/cW	100lm/cW
Lighting controls (daylighting)	N/A	Dimming/standalone
Lighting controls (occupancy)	N/A	Auto On-Off

Table 7.1 Summary of specifications to meet the building regulations

	Carbon dioxide emissions for domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	94.8
After energy demand reduction (be lean)	94.7
After heat network/CHP (be clean)	94.7
After renewable energy (be green)	31.7

Table 7.2: Carbon emissions after each stage of the energy hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	0.2	0%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	62.9	66%
Cumulative on-site savings	63.1	67%

Table 7.3: Regulated carbon savings after each stage of the energy hierarchy for domestic buildings

	Carbon dioxide emissions for non-domestic buildings (tonnes CO ₂ per annum)
	Regulated
Baseline: Part L 2021	1.7
After energy demand reduction (be lean)	2.2
After heat network/CHP (be clean)	2.2
After renewable energy (be green)	1.0

Table 7.4: Carbon emissions after each stage of the energy hierarchy for non-domestic buildings

	Regulated non-domestic carbon dioxide savings	
	(tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	-0.4	-25%
Be clean: savings from heat network/CHP	0	0%
Be green: savings from renewable energy	1.2	68%
Cumulative on-site savings	0.7	43%

Table 7.5: Regulated carbon savings after each stage of the energy hierarchy for non-domestic buildings

	Total regulated emissions (tonnes CO ₂ /year)	CO ₂ /year (tonnes CO ₂ /year)	Percentage saving (%)
Part L 2021 baseline	96.6		
Be lean	96.8	-0.3	0%
Be clean	96.8	0.0	0%
Be green	32.7	64.1	66%
Total savings		63.8	66%

Table 7.6: Site wide carbon savings

Appendix A – SAP Outputs

Full SAP Calculation Printout



Property Reference	Be Lean Crescent Terrace				Issued on Date	04/04/2025
Assessment Reference	Crescent Terrace	Prop Type Ref	Be Lean Crescent Terrace			
Property	House Type A, 1, Leywood close, Braintree, Essex, CM7 3NP					
SAP Rating	86 B	DER	12.84	TER	10.23	
Environmental	87 B	% DER < TER				-25.51
CO ₂ Emissions (t/year)	1.74	DFEE	35.94	TFEE	39.24	
Compliance Check	See BREL	% DFEE < TFEE				8.41
% DPER < TPER	-32.54	DPER	70.92	TPER	53.51	
Assessor Details	[REDACTED]				Assessor ID	W281-0001
Client	Chase new homes, Chase new homes					

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 365.1600 (4)
Dwelling volume			(5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0822 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3322 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (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	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m ²)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	31416.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.7571 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9700	0.0260	0.3372	

Full SAP Calculation Printout



E3 Sill	7.5700	0.0230	0.1741
E4 Jamb	33.6900	0.0180	0.6064
E5 Ground floor (normal)	23.8198	0.0730	1.7388
E6 Intermediate floor within a dwelling	10.7210	0.0010	0.0107
E20 Exposed floor (normal)	5.3243	0.0470	0.2502
E21 Exposed floor (inverted)	13.0920	0.3200	4.1895
P1 Party wall - Ground floor	14.1428	0.0580	0.8203
P2 Party wall - Intermediate floor within a dwelling	14.1428	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	21.5927	0.0330	0.7126
E10 Eaves (insulation at ceiling level)	16.0454	0.0550	0.8825
E16 Corner (normal)	4.8000	0.0400	0.1920
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936
E18 Party wall between dwellings	20.0000	0.0320	0.6400
P7 Party Wall - Exposed floor (normal)	7.4499	0.4800	3.5759
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.7367 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	71.0576	70.6379	70.2266	68.2947	67.9333	66.2507	66.2507	65.9391	66.8988	67.9333	68.6645	69.4289 (38)
Average = Sum(39)m / 12 =	145.3355	144.9159	144.5046	142.5727	142.2112	140.5286	140.5286	140.2170	141.1767	142.2112	142.9424	143.7069 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (42)
Hot water usage for mixer showers	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978 (42a)
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												137.4320 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210 (44)
Energy conte	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874 (45)
Energy content (annual)												Total = Sum(45)m = 2282.7173
Distribution loss (46)m = 0.15 x (45)m	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231 (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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (64)
12Total per year (kWh/year)												Total per year (kWh/year) = Sum(64)m = 2882.7173 (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)
												2883 (64)
												Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 0.0000 (64a)
Heat gains from water heating, kWh/month	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	186.8621	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708 (72)
Total internal gains	676.5748	695.1960	663.6169	640.1820	605.3622	579.8060	555.7502	556.2272	574.4803	597.5771	636.3864	661.2040 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			13.9200		10.6334		0.7200		0.7000		0.7700		51.6981 (74)
South			7.3100		46.7521		0.7200		0.7000		0.7700		119.3664 (78)
Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416	(83)

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Total gains 847.6393 989.4852 1080.5198 1191.2910 1261.9064 1250.9325 1194.5915 1112.0894 1036.4604 926.0387 841.6525 807.4457 (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	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269	
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485	
util living area	0.9966	0.9922	0.9823	0.9473	0.8548	0.6763	0.5090	0.5647	0.8096	0.9634	0.9926	0.9974 (86)	
MIT	19.6518	19.8479	20.1180	20.4896	20.7913	20.9542	20.9912	20.9854	20.8843	20.4977	20.0155	19.6259 (87)	
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (88)	
util rest of house	0.9957	0.9899	0.9770	0.9310	0.8120	0.5977	0.4102	0.4628	0.7428	0.9489	0.9900	0.9966 (89)	
MIT 2	18.4962	18.7479	19.0924	19.5621	19.9126	20.0797	20.1054	20.1044	20.0193	19.5805	18.9711	18.4698 (90)	
Living area fraction									fLA = Living area / (4) =				0.1205 (91)
MIT	18.6354	18.8804	19.2160	19.6738	20.0185	20.1850	20.2121	20.2105	20.1235	19.6910	19.0969	18.6090 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.6354	18.8804	19.2160	19.6738	20.0185	20.1850	20.2121	20.2105	20.1235	19.6910	19.0969	18.6090 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9857	0.9702	0.9216	0.8077	0.6048	0.4219	0.4747	0.7443	0.9403	0.9860	0.9947	(94)
Useful gains	842.0252	975.3759	1048.3419	1097.8765	1019.2378	756.6065	503.9962	527.8621	771.4546	870.7379	829.8854	803.1884	(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	2083.4485	2025.9889	1837.5190	1536.0528	1182.9821	784.8553	507.6020	534.3032	850.3801	1292.8386	1714.8729	2070.6792	(97)
Space heating kWh	923.6190	706.0120	587.1478	315.4869	121.8257	0.0000	0.0000	0.0000	0.0000	314.0430	637.1910	943.0131	(98a)
Space heating requirement - total per year (kWh/year)												4548.3383	
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	923.6190	706.0120	587.1478	315.4869	121.8257	0.0000	0.0000	0.0000	0.0000	314.0430	637.1910	943.0131	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4548.3383	
Space heating per m2										(98c) / (4) =		31.3808	(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 %)													88.1000 (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	923.6190	706.0120	587.1478	315.4869	121.8257	0.0000	0.0000	0.0000	0.0000	314.0430	637.1910	943.0131	(98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000	(210)
Space heating fuel (main heating system)	1048.3757	801.3757	666.4560	358.1009	138.2811	0.0000	0.0000	0.0000	0.0000	356.4619	723.2588	1070.3894	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Efficiency of water heater													79.5000 (216)
(217)m	85.8929	85.6460	85.1979	84.2003	82.2954	79.5000	79.5000	79.5000	79.5000	84.1730	85.4622	85.9455	(217)
Fuel for water heating, kWh/month	335.0033	297.0125	316.7515	280.5202	277.3823	257.7709	253.6053	264.1467	267.5862	282.9247	297.6667	330.9613	(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	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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													5162.6996 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													79.5000
Water heating fuel used													3461.3315 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)

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Electricity for lighting (calculated in Appendix L)	263.3572	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	0.0000	(233)
Wind generation	0.0000	(234)
Hydro-electric generation (Appendix N)	0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)	0.0000	(235)
Appendix Q - special features		
Energy saved or generated	-0.0000	(236)
Energy used	0.0000	(237)
Total delivered energy for all uses	8973.3882	(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	5162.6996	0.2100	1084.1669	(261)
Total CO2 associated with community systems			0.0000	(262)
Water heating (other fuel)	3461.3315	0.2100	726.8796	(264)
Space and water heating			1811.0465	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	263.3572	0.1443	38.0106	(268)
Total CO2, kg/year			1860.9864	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			12.8400	(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	5162.6996	1.1300	5833.8505	(275)
Total CO2 associated with community systems			0.0000	(276)
Water heating (other fuel)	3461.3315	1.1300	3911.3046	(278)
Space and water heating			9745.1551	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	263.3572	1.5338	403.9460	(282)
Total Primary energy kWh/year			10279.2019	(286)
Dwelling Primary energy Rate (DPER)			70.9200	(287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080	(1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400			(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1095 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3595	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3595 (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 infiltr rate	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225	(22b)
Effective ac	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892	(25)

3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K
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Main dwelling	m2		m2		m2		W/m2K		W/K		kJ/m2K		kJ/K		
TER Opaque door					1.8900		1.0000		1.8900				(26)		
TER Opening Type					21.2300		1.1450		24.3092				(27)		
Heatloss Floor 1					58.4200		0.1300		7.5946				(28a)		
Heatloss Floor 2					28.0900		0.1300		3.6517				(28b)		
External Wall 1	100.7700	23.1200			77.6500		0.1800		13.9770				(29a)		
External Roof 1	86.5200				86.5200		0.1100		9.5172				(30)		
Total net area of external elements Aum(A, m2)					273.8000								(31)		
Fabric heat loss, W/K = Sum (A x U)							(26)...(30) + (32) =		60.9397				(33)		
Main dwelling															
Party Wall 1					90.0800		0.0000		0.0000				(32)		
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K													216.7571 (35)		
List of Thermal Bridges															
K1 Element							Length		Psi-value		Total				
E2 Other lintels (including other steel lintels)							12.9700		0.0500		0.6485				
E3 Sill							7.5700		0.0500		0.3785				
E4 Jamb							33.6900		0.0500		1.6845				
E5 Ground floor (normal)							23.8198		0.1600		3.8112				
E6 Intermediate floor within a dwelling							10.7210		0.0000		0.0000				
E20 Exposed floor (normal)							5.3243		0.3200		1.7038				
E21 Exposed floor (inverted)							13.0920		0.3200		4.1895				
P1 Party wall - Ground floor							14.1428		0.0800		1.1314				
P2 Party wall - Intermediate floor within a dwelling							14.1428		0.0000		0.0000				
P4 Party wall - Roof (insulation at ceiling level)							21.5927		0.1200		2.5911				
E10 Eaves (insulation at ceiling level)							16.0454		0.0600		0.9627				
E16 Corner (normal)							4.8000		0.0900		0.4320				
E17 Corner (inverted - internal area greater than external area)							4.8000		-0.0900		-0.4320				
E18 Party wall between dwellings							20.0000		0.0600		1.2000				
P7 Party Wall - Exposed floor (normal)							7.4499		0.1600		1.1920				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													19.4932 (36)		
Point Thermal bridges											(36a) =		0.0000		
Total fabric heat loss									(33) + (36) + (36a) =				80.4328 (37)		
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)															
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047	(38)		
Heat transfer coeff	153.3457	152.8540	152.3721	150.1085	149.6850	147.7135	147.7135	147.3484	148.4729	149.6850	150.5418	151.4375	(39)		
Average = Sum(39)m / 12 =													150.1065		
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
HLP (average)	1.0580	1.0546	1.0513	1.0357	1.0327	1.0191	1.0191	1.0166	1.0244	1.0327	1.0386	1.0448	(40)		
Days in month	31	28	31	30	31	30	31	31	30	31	30	31			
4. Water heating energy requirements (kWh/year)															
Assumed occupancy													2.9260 (42)		
Hot water usage for mixer showers															
	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	(42a)		
Hot water usage for baths															
	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	(42b)		
Hot water usage for other uses															
	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	(42c)		
Average daily hot water use (litres/day)													137.4320 (43)		
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)		
Energy conte	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)		
Energy content (annual)													Total = Sum(45)m = 2282.7173		
Distribution loss (46)m = 0.15 x (45)m															
	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	(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															
	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)		
Total heat required for water heating calculated for each month															
	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(62)		
WWHRS	-33.4999	-29.6276	-31.0243	-25.6893	-23.9415	-20.4869	-19.2032	-20.4207	-21.1966	-24.9884	-28.3089	-32.8795	(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	254.2442	224.7518	238.8412	210.5095	204.3314	184.4409	182.4130	189.5759	191.5344	213.1578	226.0835	251.5668	(64)		
								Total per year (kWh/year) = Sum(64)m =						2571.4503 (64)	
12Total per year (kWh/year)													2571 (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	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743	(65)		
5. Internal gains (see Table 5 and 5a)															
Metabolic gains (Table 5), Watts															
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5															
	168.7786	168.8621	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	(67)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5															
	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652	(68)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5															
	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	(69)		
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)		
Losses e.g. evaporation (negative values) (Table 5)															
	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)		
Water heating gains (Table 5)															
	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708	(72)		
Total internal gains	676.5748	695.1960	663.6169	640.1820	605.3622	579.8060	555.7502	556.2272	574.4803	597.5771	636.3864	661.2040	(73)		

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				13.9200	10.6334	0.6300	0.7000	0.7700	45.2359 (74)			
South				7.3100	46.7521	0.6300	0.7000	0.7700	104.4456 (78)			
Solar gains	149.6814	257.5030	364.7900	482.2203	574.4762	587.2357	558.9861	486.3795	404.2327	287.4039	179.6079	127.9614 (83)
Total gains	826.2562	952.6990	1028.4069	1122.4024	1179.8384	1167.0416	1114.7363	1042.6066	978.7129	884.9810	815.9942	789.1654 (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	56.9099	57.0929	57.2735	58.1371	58.3016	59.0798	59.0798	59.2262	58.7776	58.3016	57.9698	57.6270
alpha	4.7940	4.8062	4.8182	4.8758	4.8868	4.9387	4.9387	4.9484	4.9185	4.8868	4.8647	4.8418
util living area	0.9970	0.9936	0.9864	0.9612	0.8908	0.7339	0.5654	0.6208	0.8494	0.9717	0.9937	0.9976 (86)
MIT	19.5369	19.7236	19.9921	20.3759	20.7113	20.9245	20.9833	20.9741	20.8362	20.4100	19.9162	19.5162 (87)
Th 2	20.0353	20.0381	20.0408	20.0537	20.0561	20.0674	20.0674	20.0695	20.0631	20.0561	20.0513	20.0461 (88)
util rest of house	0.9961	0.9917	0.9822	0.9482	0.8534	0.6530	0.4541	0.5087	0.7868	0.9597	0.9915	0.9969 (89)
MIT 2	18.3170	18.5573	18.9010	19.3913	19.7912	20.0179	20.0609	20.0583	19.9376	19.4411	18.8136	18.2981 (90)
Living area fraction												0.1205 (91)
MIT	18.4640	18.6978	19.0325	19.5099	19.9020	20.1271	20.1720	20.1686	20.0459	19.5578	18.9464	18.4449 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4640	18.6978	19.0325	19.5099	19.9020	20.1271	20.1720	20.1686	20.0459	19.5578	18.9464	18.4449 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9940	0.9879	0.9759	0.9385	0.8462	0.6587	0.4670	0.5213	0.7855	0.9511	0.9878	0.9951 (94)
Useful gains	821.2606	941.1242	1003.6734	1053.4045	998.3826	768.6984	520.6373	543.5281	768.7856	841.7339	806.0248	785.3101 (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	2171.9833	2109.0531	1909.5968	1592.6418	1227.7167	816.4243	527.6315	555.2963	882.8018	1340.8475	1783.3762	2157.2080 (97)
Space heating kWh	1004.9376	784.8482	674.0070	388.2509	170.6245	0.0000	0.0000	0.0000	0.0000	371.3405	703.6930	1020.6921 (98a)
Space heating requirement - total per year (kWh/year)												5118.3939
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	1004.9376	784.8482	674.0070	388.2509	170.6245	0.0000	0.0000	0.0000	0.0000	371.3405	703.6930	1020.6921 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5118.3939
Space heating per m ²										(98c) / (4) =		35.3139 (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 %)												92.4000 (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	1004.9376	784.8482	674.0070	388.2509	170.6245	0.0000	0.0000	0.0000	0.0000	371.3405	703.6930	1020.6921 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	1087.5948	849.4029	729.4448	420.1849	184.6586	0.0000	0.0000	0.0000	0.0000	401.8837	761.5725	1104.6451 (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	254.2442	224.7518	238.8412	210.5095	204.3314	184.4409	182.4130	189.5759	191.5344	213.1578	226.0835	251.5668 (64)
Efficiency of water heater	87.0183	86.8298	86.4768	85.6741	83.9976	80.3000	80.3000	80.3000	80.3000	85.5583	86.6436	87.0564 (216)
Fuel for water heating, kWh/month	292.1733	258.8417	276.1911	245.7096	243.2585	229.6898	227.1643	236.0846	238.5236	249.1373	260.9349	288.9698 (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	35.0689	28.1335	25.3311	18.5587	14.3353	11.7120	13.0771	16.9981	22.0789	28.9687	32.7200	36.0435 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-53.9613	-75.7118	-108.2718	-121.0258	-129.8111	-120.8054	-119.2102	-112.8309	-101.5442	-86.1488	-59.1557	-46.6868 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	-31.5771	-66.3098	-131.6235	-197.4818	-260.9804	-262.2740	-259.2865	-219.6830	-161.1463	-94.8759	-42.1654	-24.9875 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)

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

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

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

1. Overall dwelling characteristics

2. Ventilation rate

SAP 10 Online 2.21.16

Full SAP Calculation Printout



Pressure test
 Pressure Test Method
 Measured/design AP50
 Infiltration rate
 Number of sides sheltered

Yes
 Blower Door
 5.0000 (17)
 0.3595 (18)
 0 (19)

Shelter factor
 Infiltration rate adjusted to include shelter factor

(20) = 1 - [0.075 x (19)] = 1.0000 (20)
 (21) = (18) x (20) = 0.3595 (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	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225 (22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m2)				273.8000			(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K

(28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)
 216.7571 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9700	0.0260	0.3372
E3 Sill	7.5700	0.0230	0.1741
E4 Jamb	33.6900	0.0180	0.6064
E5 Ground floor (normal)	23.8198	0.0730	1.7388
E6 Intermediate floor within a dwelling	10.7210	0.0010	0.0107
E20 Exposed floor (normal)	5.3243	0.0470	0.2502
E21 Exposed floor (inverted)	13.0920	0.3200	4.1895
P1 Party wall - Ground floor	14.1428	0.0580	0.8203
P2 Party wall - Intermediate floor within a dwelling	14.1428	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	21.5927	0.0330	0.7126
E10 Eaves (insulation at ceiling level)	16.0454	0.0550	0.8825
E16 Corner (normal)	4.8000	0.0400	0.1920
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936
E18 Party wall between dwellings	20.0000	0.0320	0.6400
P7 Party Wall - Exposed floor (normal)	7.4499	0.4800	3.5759

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges
 Total fabric heat loss

(36a) = 0.0000
 (33) + (36) + (36a) = 74.2779 (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	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047 (38)
Heat transfer coeff	147.1908	146.6992	146.2172	143.9536	143.5301	141.5586	141.5586	141.1935	142.3180	143.5301	144.3869	145.2826 (39)
Average = Sum(39)m / 12 =												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0155	1.0121	1.0088	0.9932	0.9903	0.9767	0.9767	0.9742	0.9819	0.9903	0.9962	1.0024 (40)
HLP (average)												0.9932
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (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	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												
	147.1908	146.6992	146.2172	143.9536	143.5301	141.5586	141.5586	141.1935	142.3180	143.5301	144.3869	145.2826 (39)
Average = Sum(39)m / 12 =												
	12.2659	12.2249	12.1848	11.9961	11.9608	11.7982	11.7982	11.7653	11.8598	11.9617	12.0322	12.1069 (43)
Daily hot water use	76.2301	74.1387	71.8554	69.0139	66.4788	63.8443	63.2972	65.5758	67.9128	70.6182	73.4849	76.1232 (44)
Energy conte	120.7299	105.5725	110.4391	94.4766	89.4933	78.5040	76.5525	81.1966	83.7433	95.8283	104.6927	119.1905 (45)
Energy content (annual)												Total = Sum(45)m = 1160.4191
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												
	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119 (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												

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102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119 (64)
Total per year (kWh/year) = Sum(64)m =											986.3563 (64)
Electric shower(s)											986 (64)
58.6839	52.2878	57.0963	54.4863	55.5087	52.9499	54.7149	55.5087	54.4863	57.0963	56.0227	58.6839 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											667.5259 (64a)
Heat gains from water heating, kWh/month											
40.3261	35.5061	37.7424	33.6978	32.8945	29.9196	29.9461	31.1315	31.4170	34.6376	36.2529	39.9990 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786	168.7786 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	54.2017	52.8365	50.7290	46.8026	44.2130	41.5550	40.2502	41.8434	43.6348	46.5559	50.3512	53.7620 (72)
Total internal gains	604.8319	624.8184	596.3915	580.5573	550.2088	532.3748	511.5471	509.8719	525.5254	540.3541	571.9084	590.4952 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
North	13.9200	10.6334	0.7200	0.7000	0.7700	51.6981 (74)
South	7.3100	46.7521	0.7200	0.7000	0.7700	119.3664 (78)
Solar gains						
	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265
Total gains						
	775.8964	919.1075	1013.2943	1131.6663	1206.7530	1203.5013

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	59.2896	59.4883	59.6844	60.6229	60.8017	61.6485	61.6485	61.8079	61.3196	60.8017	60.4409	60.0683
alpha	4.9526	4.9659	4.9790	5.0415	5.0534	5.1099	5.1099	5.1205	5.0880	5.0534	5.0294	5.0046
util living area												
	0.9977	0.9944	0.9866	0.9570	0.8739	0.6998	0.5304	0.5896	0.8334	0.9718	0.9948	0.9983 (86)
MIT												
	19.5691	19.7688	20.0466	20.4375	20.7606	20.9454	20.9891	20.9819	20.8639	20.4461	19.9473	19.5470 (87)
Th 2												
	20.0704	20.0732	20.0760	20.0890	20.0914	20.1028	20.1028	20.1049	20.0984	20.0914	20.0865	20.0814 (88)
util rest of house												
	0.9971	0.9927	0.9825	0.9431	0.8340	0.6207	0.4277	0.4842	0.7695	0.9601	0.9930	0.9977 (89)
MIT 2												
	18.7553	18.9563	19.2340	19.6251	19.9223	20.0754	20.0995	20.0989	20.0182	19.6402	19.1451	18.7417 (90)
Living area fraction												
	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387 (91)
MIT												
	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387 (92)
Temperature adjustment												
	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9902	0.9780	0.9361	0.8306	0.6280	0.4399	0.4965	0.7713	0.9541	0.9906	0.9967 (94)
Useful gains	772.6515	910.0873	991.0432	1059.4084	1002.2887	755.7457	506.0539	529.1663	761.6145	828.9139	769.8881	734.3422 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W												
	2142.1217	2076.4070	1876.2431	1557.9996	1194.6432	789.9268	510.5573	537.2773	856.7617	1311.4813	1753.1132	2126.7514 (97)
Space heating kWh												
	1018.8858	783.7668	658.5887	358.9857	143.1117	0.0000	0.0000	0.0000	0.0000	359.0301	707.9221	1035.9524 (98a)
Space heating requirement - total per year (kWh/year)												
												5066.2434
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												
	1018.8858	783.7668	658.5887	358.9857	143.1117	0.0000	0.0000	0.0000	0.0000	359.0301	707.9221	1035.9524 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												
												5066.2434
Space heating per m2												
										(98c) / (4) =		34.9541 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	1330.6511	1047.5338	1073.0708	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.8352	0.9050	0.8715	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	1111.4106	948.0263	935.1877	0.0000	0.0000	0.0000	0.0000 (102)
Total gains												
	0.0000	0.0000	0.0000	0.0000	0.0000	1327.1835	1268.5903	1173.1014	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	155.3565	238.4996	177.0078	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												
												fc = cooled area / (4) =
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)

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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.8391	59.6249	44.2519	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement													142.7160 (107)
Energy for space heating													34.9541 (99)
Energy for space cooling													0.9847 (108)
Total													35.9387 (109)
Fabric Energy Efficiency (DFEE)													35.9 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area IFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (5)

2. Ventilation rate

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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1095 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3595	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3595 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													(23c)
Effective ac	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			21.2300	1.1450	24.3092		(27)
Heatloss Floor 1			58.4200	0.1300	7.5946		(28a)
Heatloss Floor 2			28.0900	0.1300	3.6517		(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1800	13.9770		(29a)
External Roof 1	86.5200		86.5200	0.1100	9.5172		(30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.9397		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000		(32)
Thermal mass parameter (IMP = Cm / TFA) in kJ/m2K							216.7571 (35)
List of Thermal Bridges							
K1 Element			Length	Psi-value	Total		
E2 Other lintels (including other steel lintels)			12.9700	0.0500	0.6485		
E3 Sill			7.5700	0.0500	0.3785		
E4 Jamb			33.6900	0.0500	1.6845		
E5 Ground floor (normal)			23.8198	0.1600	3.8112		
E6 Intermediate floor within a dwelling			10.7210	0.0000	0.0000		
E20 Exposed floor (normal)			5.3243	0.3200	1.7038		
E21 Exposed floor (inverted)			13.0920	0.3200	4.1895		
P1 Party wall - Ground floor			14.1428	0.0800	1.1314		
P2 Party wall - Intermediate floor within a dwelling			14.1428	0.0000	0.0000		
P4 Party wall - Roof (insulation at ceiling level)			21.5927	0.1200	2.5911		
E10 Eaves (insulation at ceiling level)			16.0454	0.0600	0.9627		
E16 Corner (normal)			4.8000	0.0900	0.4320		
E17 Corner (inverted - internal area greater than external area)			4.8000	-0.0900	-0.4320		
E18 Party wall between dwellings			20.0000	0.0600	1.2000		
P7 Party Wall - Exposed floor (normal)			7.4499	0.1600	1.1920		
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.4932 (36)
Point Thermal bridges						(36a) =	0.0000
Total fabric heat loss						(33) + (36) + (36a) =	80.4328 (37)

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Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047 (38)
Average = Sum(39)m / 12 =	153.3457	152.8540	152.3721	150.1085	149.6850	147.7135	147.7135	147.3484	148.4729	149.6850	150.5418	151.4375 (39)
												150.1065

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0580	1.0546	1.0513	1.0357	1.0327	1.0191	1.0191	1.0166	1.0244	1.0327	1.0386	1.0448 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	1.0356
												31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (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	(42a)
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												69.8717 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	76.2301	74.1387	71.8554	69.0139	66.4788	63.8443	63.2972	65.5758	67.9128	70.6182	73.4849	76.1232 (44)
Energy content (annual)	120.7299	105.5725	110.4391	94.4766	89.4933	78.5040	76.5525	81.1966	83.7433	95.8283	104.6927	119.1905 (45)
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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119 (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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119 (64)
12Total per year (kWh/year)												986.3563 (64)
Electric shower(s)	58.6839	52.2878	57.0963	54.4863	55.5087	52.9499	54.7149	55.5087	54.4863	57.0963	56.0227	58.6839 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												667.5259 (64a)
Heat gains from water heating, kWh/month	40.3261	35.5061	37.7424	33.6978	32.8945	29.9196	29.9461	31.1315	31.4170	34.6376	36.2529	39.9990 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	54.2017	52.8365	50.7290	46.8026	44.2130	41.5550	40.2502	41.8434	43.6348	46.5559	50.3512	53.7620 (72)
Total internal gains	604.8319	624.8184	596.3915	580.5573	550.2088	532.3748	511.5471	509.8719	525.5254	540.3541	571.9084	590.4952 (73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					13.9200	10.6334	0.6300	0.7000	0.7700			45.2359 (74)
South					7.3100	46.7521	0.6300	0.7000	0.7700			104.4456 (78)
Solar gains	149.6814	257.5030	364.7900	482.2203	574.4762	587.2357	558.9861	486.3795	404.2327	287.4039	179.6079	127.9614 (83)
Total gains	754.5133	882.3214	961.1814	1062.7277	1124.6850	1119.6105	1070.5332	996.2514	929.7580	827.7580	751.5163	718.4567 (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	56.9099	57.0929	57.2735	58.1371	58.3016	59.0798	59.0798	59.2262	58.7776	58.3016	57.9698	57.6270
alpha	4.7940	4.8062	4.8182	4.8758	4.8868	4.9387	4.9387	4.9484	4.9185	4.8868	4.8647	4.8418
util living area	0.9980	0.9954	0.9897	0.9682	0.9053	0.7545	0.5857	0.6444	0.8687	0.9781	0.9956	0.9984 (86)
MIT	19.4773	19.6660	19.9389	20.3338	20.6834	20.9145	20.9806	20.9696	20.8161	20.3674	19.8632	19.4571 (87)
Th 2	20.0353	20.0381	20.0408	20.0537	20.0561	20.0674	20.0674	20.0695	20.0631	20.0561	20.0513	20.0461 (88)
util rest of house												

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MIT 2	0.9974	0.9940	0.9864	0.9572	0.8710	0.6746	0.4718	0.5303	0.8101	0.9685	0.9940	0.9980 (89)
Living area fraction	18.6368	18.8270	19.1003	19.4978	19.8266	20.0230	20.0614	20.0590	19.9510	19.5365	19.0342	18.6250 (90)
MIT	18.7381	18.9281	19.2013	19.5985	19.9298	20.1304	20.1721	20.1687	fLA = Living area / (4) =			0.1205 (91)
Temperature adjustment									20.0552	19.6366	19.1341	18.7252 (92)
adjusted MIT	18.7381	18.9281	19.2013	19.5985	19.9298	20.1304	20.1721	20.1687	20.0552	19.6366	19.1341	18.7252 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9917	0.9824	0.9504	0.8656	0.6805	0.4852	0.5433	0.8095	0.9627	0.9919	0.9970 (94)	
Useful gains	751.6539	875.0033	944.2907	1010.0937	973.4966	761.8789	519.3977	541.2490	752.6313	796.9015	745.3959	716.3069 (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	2214.0158	2144.2454	1935.3225	1605.9400	1231.8742	816.9081	527.6501	555.3135	884.1826	1352.6393	1811.6316	2199.6668 (97)	
Space heating kWh	1087.9973	852.9307	737.3276	429.0094	192.2329	0.0000	0.0000	0.0000	0.0000	413.4689	767.6897	1103.6198 (98a)	
Space heating requirement - total per year (kWh/year)												5584.2764	
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	1087.9973	852.9307	737.3276	429.0094	192.2329	0.0000	0.0000	0.0000	0.0000	413.4689	767.6897	1103.6198 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												5584.2764	
Space heating per m2												(98c) / (4) =	38.5282 (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	1388.5069	1093.0799	1119.8479	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7772	0.8603	0.8212	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.1674	940.3310	919.6176	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1229.1293	1175.2531	1091.8877	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	107.9726	174.7821	128.1690	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	26.9932	43.6955	32.0422	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												102.7309 (107)
Energy for space heating												38.5282 (99)
Energy for space cooling												0.7088 (108)
Total												39.2370 (109)
Fabric Energy Efficiency (TFEE)												39.2 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.0822 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3322 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (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)

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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	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			21.2300	1.1450	24.3092			(27)
Front Door			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000	(28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000	(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000	(29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800	(30)
Total net area of external elements Aum(A, m2)			273.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	60.5413		(33)
Main dwelling								
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000	(32)
Ground Floor			59.5600			9.0000	536.0400	(32c)
1st Floor			173.9100			9.0000	1565.1900	(32c)
Internal Floor 1			58.4200			18.0000	1051.5600	(32d)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(34)
List of Thermal Bridges								(35)
K1 Element					Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)					12.9700	0.0260	0.3372	
E3 Sill					7.5700	0.0230	0.1741	
E4 Jamb					33.6900	0.0180	0.6064	
E5 Ground floor (normal)					23.8198	0.0730	1.7388	
E6 Intermediate floor within a dwelling					10.7210	0.0010	0.0107	
E20 Exposed floor (normal)					5.3243	0.0470	0.2502	
E21 Exposed floor (inverted)					13.0920	0.3200	4.1895	
P1 Party wall - Ground floor					14.1428	0.0580	0.8203	
P2 Party wall - Intermediate floor within a dwelling					14.1428	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)					21.5927	0.0330	0.7126	
E10 Eaves (insulation at ceiling level)					16.0454	0.0550	0.8825	
E16 Corner (normal)					4.8000	0.0400	0.1920	
E17 Corner (inverted - internal area greater than external area)					4.8000	-0.0820	-0.3936	
E18 Party wall between dwellings					20.0000	0.0320	0.6400	
P7 Party Wall - Exposed floor (normal)					7.4499	0.4800	3.5759	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7367	(36)
Point Thermal bridges							0.0000	
Total fabric heat loss							(33) + (36) + (36a) =	74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	71.0576	70.6379	70.2266	68.2947	67.9333	66.2507	66.2507	65.9391	66.8988	67.9333	68.6645	69.4289	(38)
Average = Sum(39)m / 12 =	145.3355	144.9159	144.5046	142.5727	142.2112	140.5286	140.5286	140.2170	141.1767	142.2112	142.9424	143.7069	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	72.9978	(42a)
Hot water usage for baths													
31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	31.5284	(42b)
Hot water usage for other uses													
44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	44.5947	(42c)
Average daily hot water use (litres/day)													137.4320 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)
Energy content (annual)	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Distribution loss (46)m = 0.15 x (45)m													
35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	35.0231	(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	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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	284.4463	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Heat gains from water heating, kWh/month	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743	(65)

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	(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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708	(72)
Total internal gains	747.3192	745.2985	721.5626	677.3238	632.0811	588.2795	564.0411	567.0766	589.9439	633.8447	683.0768	726.1398	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.9200	10.6334	0.7200	0.7000	0.7700	51.6981 (74)
South	7.3100	46.7521	0.7200	0.7000	0.7700	119.3664 (78)

Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416	(83)
Total gains	918.3837	1039.5876	1138.4654	1228.4327	1288.6253	1259.4060	1202.8823	1122.9389	1051.9241	962.3063	888.3430	872.3814	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269	
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485	
util living area	0.9952	0.9903	0.9782	0.9413	0.8465	0.6727	0.5057	0.5598	0.8029	0.9577	0.9906	0.9962	(86)
MIT	19.7108	19.8886	20.1626	20.5134	20.8016	20.9553	20.9914	20.9860	20.8890	20.5230	20.0536	19.6804	(87)
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904	(88)
util rest of house	0.9938	0.9876	0.9718	0.9236	0.8025	0.5942	0.4074	0.4585	0.7352	0.9414	0.9875	0.9952	(89)
MIT 2	18.5714	18.7995	19.1479	19.5900	19.9231	20.0804	20.1055	20.1047	20.0233	19.6104	19.0193	18.5393	(90)
Living area fraction													
MIT	18.7087	18.9307	19.2701	19.7013	20.0289	20.1858	20.2122	20.2108	20.1275	19.7203	19.1439	18.6768	(91)
Temperature adjustment												0.0000	(92)
adjusted MIT	18.7087	18.9307	19.2701	19.7013	20.0289	20.1858	20.2122	20.2108	20.1275	19.7203	19.1439	18.6768	(93)

8. Space heating requirement

Utilisation	0.9908	0.9828	0.9642	0.9141	0.7987	0.6014	0.4191	0.4703	0.7372	0.9326	0.9828	0.9927	(94)
Useful gains	909.9803	1021.6935	1097.7613	1122.9188	1029.2164	757.4205	504.1215	528.1636	775.4294	897.4419	873.0522	866.0516	(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	2094.0886	2033.2771	1845.3414	1539.9634	1184.4617	784.9661	507.6190	534.3439	850.9483	1297.0125	1721.5898	2080.4159	(97)
Space heating kWh	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870	(98a)
Space heating requirement - total per year (kWh/year)												4344.4497	
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	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4344.4497	
Space heating per m ²												29.9741	(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 %)													88.1000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870	(98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000	(210)
Space heating fuel (main heating system)	999.9735	771.6052	631.3276	340.8310	131.1038	0.0000	0.0000	0.0000	0.0000	337.4353	693.4700	1025.5244	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Efficiency of water heater	85.8145	85.5791	85.0928	84.0947	82.1958	79.5000	79.5000	79.5000	79.5000	84.0557	85.3846	85.8756	(216)
Fuel for water heating, kWh/month	335.3095	297.2448	317.1424	280.8724	277.7185	257.7709	253.6053	264.1467	267.5862	283.3195	297.9370	331.2306	(217)
Space cooling fuel requirement													(219)

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(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	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												4931.2709	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.5000	
Water heating fuel used												3463.8836	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												263.3572	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												0.0000	(233)
Wind generation												0.0000	(234)
Hydro-electric generation (Appendix N)												0.0000	(235a)
Electricity generated - Micro CHP (Appendix N)												0.0000	(235)
Appendix Q - special features													
Energy saved or generated												-0.0000	(236)
Energy used												0.0000	(237)
Total delivered energy for all uses												8744.5117	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4931.2709	3.6400	179.4983 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3463.8836	3.6400	126.0854 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814 (249)
Energy for lighting	263.3572	16.4900	43.4276 (250)
Additional standing charges			92.0000 (251)
Total energy cost			455.1926 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8627 (257)
SAP value		86.0149
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4931.2709	0.2100	1035.5669 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3463.8836	0.2100	727.4156 (264)
Space and water heating			1762.9824 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Total CO2, kg/year			1812.9223 (272)
CO2 emissions per m2			12.5100 (273)
EI value			87.2101
EI rating			87 (274)
EI band			B

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)

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Dwelling volume

(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 365.1600 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.0822	(8)
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000 (17)		
Infiltration rate	0.3322 (18)		
Number of sides sheltered	0 (19)		
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)		
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (21)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.7000	4.6000	4.1000	4.0000	3.6000	3.7000	3.7000	3.9000	4.2000	4.2000	4.5000 (22)
Wind factor	1.2250	1.1750	1.1500	1.0250	1.0000	0.9000	0.9250	0.9250	0.9750	1.0500	1.0500	1.1250 (22a)
Adj infiltr rate	0.4069	0.3903	0.3820	0.3405	0.3322	0.2989	0.3072	0.3072	0.3239	0.3488	0.3488	0.3737 (22b)
Effective ac	0.5828	0.5762	0.5730	0.5580	0.5552	0.5447	0.5472	0.5472	0.5524	0.5608	0.5608	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 216.7571 (35)

List of Thermal Bridges	Length	Psi value	Total
K1 Element	12.9700	0.0260	0.3372
E2 Other lintels (including other steel lintels)	7.5700	0.0230	0.1741
E3 Sill	33.6900	0.0180	0.6064
E4 Jamb	23.8198	0.0730	1.7388
E5 Ground floor (normal)	10.7210	0.0010	0.0107
E6 Intermediate floor within a dwelling	5.3243	0.0470	0.2502
E20 Exposed floor (normal)	13.0920	0.3200	4.1895
E21 Exposed floor (inverted)	14.1428	0.0580	0.8203
P1 Party wall - Ground floor	14.1428	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	21.5927	0.0330	0.7126
P4 Party wall - Roof (insulation at ceiling level)	16.0454	0.0550	0.8825
E10 Eaves (insulation at ceiling level)	4.8000	0.0400	0.1920
E16 Corner (normal)	4.8000	-0.0820	-0.3936
E17 Corner (inverted - internal area greater than external area)	20.0000	0.0320	0.6400
E18 Party wall between dwellings	7.4499	0.4800	3.5759
P7 Party Wall - Exposed floor (normal)			

Thermal bridges (Sum(L x Psi) calculated using Appendix K) (36a) = 13.7367 (36)

Point Thermal bridges (33) + (36) + (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	70.2266	69.4289	69.0426	67.2353	66.8988	65.6358	65.9391	65.9391	66.5706	67.5801	67.5801	68.6645 (38)
Average = Sum(39)m / 12 =	144.5046	143.7069	143.3205	141.5132	141.1767	139.9137	140.2170	140.2170	140.8485	141.8581	141.8581	142.9424 (39)
												141.8397

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9970	0.9915	0.9888	0.9764	0.9740	0.9653	0.9674	0.9674	0.9718	0.9787	0.9787	0.9862 (40)
HLP (average)												0.9786
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9260 (42)											
Hot water usage for mixer showers	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978 (42a)
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												137.4320 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Daily hot water use	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210 (44)
Energy conte	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2282.7173
35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231 (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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (64)
										Total per year (kWh/year) = Sum(64)m =		2882.7173 (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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708 (72)
Total internal gains	747.3192	745.2985	721.5626	677.3238	632.0811	588.2795	564.0411	567.0766	589.9439	633.8447	683.0768	726.1398 (73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					13.9200	12.0246	0.7200	0.7000	0.7700		58.4622 (74)	
South					7.3100	51.4430	0.7200	0.7000	0.7700		131.3432 (78)	
Solar gains	189.8054	299.6057	422.2821	589.1663	675.0350	727.9198	685.2635	601.4045	498.3736	356.0936	233.4191	160.6498 (83)
Total gains	937.1246	1044.9042	1143.8447	1266.4901	1307.1161	1316.1993	1249.3046	1168.4811	1088.3175	989.9383	916.4959	886.7896 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	60.3917	60.7269	60.8907	61.6683	61.8153	62.3733	62.2384	62.2384	61.9593	61.5184	61.5184	61.0517
alpha	5.0261	5.0485	5.0594	5.1112	5.1210	5.1582	5.1492	5.1492	5.1306	5.1012	5.1012	5.0701
util living area	0.9944	0.9900	0.9755	0.9258	0.8095	0.5870	0.3909	0.4287	0.7249	0.9417	0.9881	0.9956 (86)
MIT	19.7610	19.9075	20.2144	20.5861	20.8542	20.9787	20.9979	20.9967	20.9397	20.6078	20.1234	19.7384 (87)
Th 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948 (88)
util rest of house	0.9928	0.9872	0.9683	0.9041	0.7579	0.5036	0.2926	0.3246	0.6420	0.9193	0.9841	0.9944 (89)
MIT 2	18.6390	18.8286	19.2182	19.6812	19.9827	20.1007	20.1101	20.1097	20.0688	19.7136	19.1124	18.6166 (90)
Living area fraction	18.7741	18.9586	19.3382	19.7902	20.0876	20.2065	20.2170	20.2166	20.1737	19.8213	19.2341	18.7518 (91)
Temperature adjustment												0.0000
adjusted MIT	18.7741	18.9586	19.3382	19.7902	20.0876	20.2065	20.2170	20.2166	20.1737	19.8213	19.2341	18.7518 (93)

8. Space heating requirement

Utilisation	0.9896	0.9824	0.9605	0.8950	0.7568	0.5127	0.3045	0.3371	0.6487	0.9106	0.9788	0.9916 (94)
Useful gains	927.3439	1026.4803	1098.6203	1133.5264	989.1875	674.8373	380.3868	393.9473	706.0327	901.4064	897.0293	879.3583 (95)
Ext temp.	4.5000	4.9000	6.8000	9.3000	12.3000	15.3000	17.5000	17.4000	14.9000	11.2000	7.4000	4.5000 (96)
Heat loss rate W	2062.6792	2020.3142	1796.9816	1484.4986	1099.4345	686.4847	380.9720	394.9294	742.7945	1223.0038	1678.7696	2037.1813 (97)
Space heating kWh	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203 (98a)
Space heating requirement - total per year (kWh/year)												4030.3921
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	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4030.3921
Space heating per m2												27.8073 (99)

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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 %)												88.1000	(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	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203	(98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000	(210)
Space heating fuel (main heating system)	958.7848	758.0662	589.7626	286.8331	93.1030	0.0000	0.0000	0.0000	0.0000	271.5874	638.8797	977.7755	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Efficiency of water heater	85.7432	85.5474	84.9583	83.7244	81.6057	79.5000	79.5000	79.5000	79.5000	83.5894	85.2300	85.7961	(216)
Fuel for water heating, kWh/month	335.5883	297.3548	317.6445	282.1149	279.7266	257.7709	253.6053	264.1467	267.5862	284.8999	298.4774	331.5376	(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	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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													4574.7924 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													79.5000
Water heating fuel used													3470.4529 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
central heating pump													41.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													86.0000 (231)
Electricity for lighting (calculated in Appendix L)													263.3572 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation													0.0000 (233)
Wind generation													0.0000 (234)
Hydro-electric generation (Appendix N)													0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)													0.0000 (235)
Appendix Q - special features													
Energy saved or generated													-0.0000 (236)
Energy used													0.0000 (237)
Total delivered energy for all uses													8394.6025 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4574.7924	5.6000	256.1884 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3470.4529	5.6000	194.3454 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116 (249)
Energy for lighting	263.3572	26.0600	68.6309 (250)
Additional standing charges			99.0000 (251)
Total energy cost			640.5762 (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	4574.7924	0.2100	960.7064 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3470.4529	0.2100	728.7951 (264)
Space and water heating			1689.5015 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Total CO2, kg/year			1739.4414 (272)

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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	4574.7924	1.1300	5169.5155 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3470.4529	1.1300	3921.6118 (278)
Space and water heating			9091.1272 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	263.3572	1.5338	403.9460 (282)
Total Primary energy kWh/year			9625.1740 (286)

SAP 10 EPC IMPROVEMENTS

Crescent Terrace

Current energy efficiency rating: B 86
Current environmental impact rating: B 87

N Solar water heating			SAP increase too small
U Solar photovoltaic panels			Recommended
V2 Wind turbine			Not applicable
Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 4.2	-£ 228	-117 kg (6.7%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.5	-£ 28	-172 kg (9.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£228 0.81 kg/m²	B 90	B 88
Total Savings	£228 0.81 kg/m²		
Potential energy efficiency rating:		B 90	
Potential environmental impact rating:			B 88

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£91	£91	£0
Mains gas	£550	£550	£0
Space heating	£378	£378	£0
Water heating	£194	£194	£0
Lighting	£69	£69	£0
Generated (PV)	-£0	-£228	£228
Total cost of fuels	£641	£413	£228
Total cost of uses	£641	£413	£228
Delivered energy	58 kWh/m²	52 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.7 tonnes	1.6 tonnes	0.1 tonnes
CO2 emissions per m²	12 kg/m²	11 kg/m²	1 kg/m²
Primary energy	66 kWh/m²	57 kWh/m²	9 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(7a)+(7b)+(7c) = 30.0000 / (5) = 0.0822 (8)
Pressure test	Yes

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Pressure Test Method
Measured/design AP50
Infiltration rate
Number of sides sheltered

Blower Door
5.0000 (17)
0.3322 (18)
0 (19)

Shelter factor
Infiltration rate adjusted to include shelter factor

$$(20) = 1 - [0.075 \times (19)] = 1.0000 (20)$$

$$(21) = (18) \times (20) = 0.3322 (21)$$

	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													
Effective ac	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3322	0.3571	0.3737	0.3903	(22b)
	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			21.2300	1.1450	24.3092			(27)
Front Door			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000	(28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000	(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000	(29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800	(30)
Total net area of external elements Aum(A, m2)			273.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	60.5413		(33)
Main dwelling								
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000	(32)
Ground Floor			59.5600			9.0000	536.0400	(32c)
1st Floor			173.9100			9.0000	1565.1900	(32c)
Internal Floor 1			58.4200			18.0000	1051.5600	(32d)

$$\text{Heat capacity } C_m = \text{Sum}(A \times k)$$

$$\text{Thermal mass parameter (TMP) = } C_m / \text{TFA} \text{ in kJ/m2K}$$

$$(28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)$$

$$216.7571 (35)$$

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9700	0.0260	0.3372
E2 Other lintels (including other steel lintels)	7.5700	0.0230	0.1741
E3 Sill	33.6900	0.0180	0.6064
E4 Jamb	23.8198	0.0730	1.7388
E5 Ground floor (normal)	10.7210	0.0010	0.0107
E6 Intermediate floor within a dwelling	5.3243	0.0470	0.2502
E20 Exposed floor (normal)	13.0920	0.3200	4.1895
E21 Exposed floor (inverted)	14.1428	0.0580	0.8203
P1 Party wall - Ground floor	14.1428	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	21.5927	0.0330	0.7126
P4 Party wall - Roof (insulation at ceiling level)	16.0454	0.0550	0.8825
E10 Eaves (insulation at ceiling level)	4.8000	0.0400	0.1920
E16 Corner (normal)	4.8000	-0.0820	-0.3936
E17 Corner (inverted - internal area greater than external area)	20.0000	0.0320	0.6400
E18 Party wall between dwellings	7.4499	0.4800	3.5759
P7 Party Wall - Exposed floor (normal)			

$$\text{Thermal bridges (Sum}(L \times \text{Psi}) \text{ calculated using Appendix K)}$$

$$\text{Point Thermal bridges} \quad (36a) = 13.7367 (36)$$

$$\text{Total fabric heat loss} \quad (33) + (36) + (36a) = 74.2779 (37)$$

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	71.0576	70.6379	70.2266	68.2947	67.9333	66.2507	66.2507	65.9391	66.8988	67.9333	68.6645	69.4289	(38)
Heat transfer coeff	145.3355	144.9159	144.5046	142.5727	142.2112	140.5286	140.5286	140.2170	141.1767	142.2112	142.9424	143.7069	(39)
Average = Sum(39)m / 12 =												142.5709	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915	(40)
HLP (average)												0.9837	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	72.9978	(42a)
Hot water usage for baths													
31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	31.5284	(42b)
Hot water usage for other uses													
44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	44.5947	(42c)
Average daily hot water use (litres/day)												137.4320	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)
Energy conte	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	35.0231	(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	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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	284.4463	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Electric shower(s)													
	Total per year (kWh/year) = Sum(64)m =											2882.7173 (64)	

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	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 =												
Heat gains from water heating, kWh/month	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743 (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	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708 (72)
Total internal gains	747.3192	745.2985	721.5626	677.3238	632.0811	588.2795	564.0411	567.0766	589.9439	633.8447	683.0768	726.1398 (73)

6. Solar gains

[Jan]	Area		Solar flux		g		FF		Access		Gains	
	m2		Table 6a		Specific data		Specific data		factor		W	
			W/m2		or Table 6b		or Table 6c		Table 6d			
North	13.9200		10.6334		0.7200		0.7000		0.7700		51.6981 (74)	
South	7.3100		46.7521		0.7200		0.7000		0.7700		119.3664 (78)	
Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416 (83)
Total gains	918.3837	1039.5876	1138.4654	1228.4327	1288.6253	1259.4060	1202.8823	1122.9389	1051.9241	962.3063	888.3430	872.3814 (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	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485
util living area	0.9952	0.9903	0.9782	0.9413	0.8465	0.6727	0.5057	0.5598	0.8029	0.9577	0.9906	0.9962 (86)
MIT	19.7108	19.8886	20.1626	20.5134	20.8016	20.9553	20.9914	20.9860	20.8890	20.5230	20.0536	19.6804 (87)
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (88)
util rest of house	0.9938	0.9876	0.9718	0.9236	0.8025	0.5942	0.4074	0.4585	0.7352	0.9414	0.9875	0.9952 (89)
MIT 2	18.5714	18.7995	19.1479	19.5900	19.9231	20.0804	20.1055	20.1047	20.0233	19.6104	19.0193	18.5393 (90)
Living area fraction	18.7087	18.9307	19.2701	19.7013	20.0289	20.1858	20.2122	20.2108	20.1275	19.7203	19.1439	18.6768 (91)
MIT	18.7087	18.9307	19.2701	19.7013	20.0289	20.1858	20.2122	20.2108	20.1275	19.7203	19.1439	18.6768 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7087	18.9307	19.2701	19.7013	20.0289	20.1858	20.2122	20.2108	20.1275	19.7203	19.1439	18.6768 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9908	0.9828	0.9642	0.9141	0.7987	0.6014	0.4191	0.4703	0.7372	0.9326	0.9828	0.9927 (94)
Useful gains	909.9803	1021.6935	1097.7613	1122.9188	1029.2164	757.4205	504.1215	528.1636	775.4294	897.4419	873.0522	866.0516 (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	2094.0886	2033.2771	1845.3414	1539.9634	1184.4617	784.9661	507.6190	534.3439	850.9483	1297.0125	1721.5898	2080.4159 (97)
Space heating kWh	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870 (98a)
Space heating requirement - total per year (kWh/year)												4344.4497
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	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4344.4497
Space heating per m2										(98c) / (4) =		29.9741 (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 %)												88.1000 (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	880.9766	679.7842	556.1996	300.2721	115.5025	0.0000	0.0000	0.0000	0.0000	297.2805	610.9471	903.4870 (98)
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000 (210)
Space heating fuel (main heating system)	999.9735	771.6052	631.3276	340.8310	131.1038	0.0000	0.0000	0.0000	0.0000	337.4353	693.4700	1025.5244 (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)

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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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)
Efficiency of water heater													
(217)m	85.8145	85.5791	85.0928	84.0947	82.1958	79.5000	79.5000	79.5000	79.5000	84.0557	85.3846	85.8756	(217)
Fuel for water heating, kWh/month	335.3095	297.2448	317.1424	280.8724	277.7185	257.7709	253.6053	264.1467	267.5862	283.3195	297.9370	331.2306	(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	7.0685	7.3041	7.0685	7.3041	7.0685	(231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.2415	-51.6633	-77.2896	-90.4715	-100.4927	-94.7914	-93.4867	-86.7004	-75.3064	-60.4908	-39.3887	-30.2253	(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												4931.2709	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												79.5000	
Water heating fuel used												3463.8836	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												86.0000	(231)
Electricity for lighting (calculated in Appendix L)												263.3572	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-835.5482	(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												7908.9634	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4931.2709	3.6400	179.4983
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3463.8836	3.6400	126.0854
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000
Pumps, fans and electric keep-hot	86.0000	16.4900	14.1814
Energy for lighting	263.3572	16.4900	43.4276
Additional standing charges			92.0000
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-835.5482	16.4900	-137.7819
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-137.7819
Total energy cost			317.4107

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6016	(257)
SAP value		90.2481	
SAP rating (Section 12)		90	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4931.2709	0.2100	1035.5669
Total CO2 associated with community systems			0.0000
Water heating (other fuel)	3463.8836	0.2100	727.4156
Space and water heating			1762.9824
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293
Energy for lighting	263.3572	0.1443	38.0106
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-835.5482	0.1338	-111.7892
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-111.7892
Total CO2, kg/year			1701.1331
CO2 emissions per m2			11.7400
EI value			87.9987
EI rating			88
EI band			B

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0822 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3322 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.7000	4.6000	4.1000	4.0000	3.6000	3.7000	3.7000	3.9000	4.2000	4.2000	4.5000 (22)
Wind factor	1.2250	1.1750	1.1500	1.0250	1.0000	0.9000	0.9250	0.9250	0.9750	1.0500	1.0500	1.1250 (22a)
Adj infiltr rate	0.4069	0.3903	0.3820	0.3405	0.3322	0.2989	0.3072	0.3072	0.3239	0.3488	0.3488	0.3737 (22b)
Effective ac	0.5828	0.5762	0.5730	0.5580	0.5552	0.5447	0.5472	0.5472	0.5524	0.5608	0.5608	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	31416.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							216.7571 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	12.9700	0.0260	0.3372
E2 Other lintels (including other steel lintels)	7.5700	0.0230	0.1741
E3 Sill	33.6900	0.0180	0.6064
E4 Jamb	23.8198	0.0730	1.7388
E5 Ground floor (normal)	10.7210	0.0010	0.0107
E6 Intermediate floor within a dwelling	5.3243	0.0470	0.2502
E20 Exposed floor (normal)	13.0920	0.3200	4.1895
E21 Exposed floor (inverted)	14.1428	0.0580	0.8203
P1 Party wall - Ground floor	14.1428	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	21.5927	0.0330	0.7126
P4 Party wall - Roof (insulation at ceiling level)	16.0454	0.0550	0.8825
E10 Eaves (insulation at ceiling level)	4.8000	0.0400	0.1920
E16 Corner (normal)	4.8000	-0.0820	-0.3936
E17 Corner (inverted - internal area greater than external area)	20.0000	0.0320	0.6400
E18 Party wall between dwellings	7.4499	0.4800	3.5759
P7 Party Wall - Exposed floor (normal)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.7367 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.2779 (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	70.2266	69.4289	69.0426	67.2353	66.8988	65.6358	65.9391	65.9391	66.5706	67.5801	67.5801	68.6645 (38)
Heat transfer coeff	144.5046	143.7069	143.3205	141.5132	141.1767	139.9137	140.2170	140.2170	140.8485	141.8581	141.8581	142.9424 (39)
Average = Sum(39)m / 12 =												141.8397

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HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9970	0.9915	0.9888	0.9764	0.9740	0.9653	0.9674	0.9674	0.9718	0.9787	0.9787	0.9862	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (42)	
Hot water usage for mixer showers	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978 (42a)	
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)	
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)	
Average daily hot water use (litres/day)												137.4320 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210 (44)	
Distribution loss (46)m = 0.15 x (45)m	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874 (45)	
Total = Sum(45)m =	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231 (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	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (62)	
WHRS	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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463 (64)	
Electric shower(s)	Total per year (kWh/year) = Sum(64)m =											2882.7173 (64)	
	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	91.4708	80.7839	85.5262	74.4676	71.6966	64.0700	62.8333	65.6198	66.6646	74.9795	80.5170	90.3743 (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	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	(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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)	122.9446	120.2141	114.9545	103.4273	96.3665	88.9861	84.4533	88.1986	92.5897	100.7789	111.8291	121.4708	(72)
Total internal gains	747.3192	745.2985	721.5626	677.3238	632.0811	588.2795	564.0411	567.0766	589.9439	633.8447	683.0768	726.1398	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North						13.9200	12.0246	0.7200	0.7000	0.7700	58.4622	(74)	
South						7.3100	51.4430	0.7200	0.7000	0.7700	131.3432	(78)	
Solar gains	189.8054	299.6057	422.2821	589.1663	675.0350	727.9198	685.2635	601.4045	498.3736	356.0936	233.4191	160.6498	(83)
Total gains	937.1246	1044.9042	1143.8447	1266.4901	1307.1161	1316.1993	1249.3046	1168.4811	1088.3175	989.9383	916.4959	866.7896	(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	60.3917	60.7269	60.8907	61.6683	61.8153	62.3733	62.2384	62.2384	61.9593	61.5184	61.5184	61.0517	
alpha	5.0261	5.0485	5.0594	5.1112	5.1210	5.1582	5.1492	5.1492	5.1306	5.1012	5.1012	5.0701	
util living area	0.9944	0.9900	0.9755	0.9258	0.8095	0.5870	0.3909	0.4287	0.7249	0.9417	0.9881	0.9956	(86)
MIT	19.7610	19.9075	20.2144	20.5861	20.8542	20.9787	20.9979	20.9967	20.9397	20.6078	20.1234	19.7384	(87)
Th 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948	(88)
util rest of house	0.9928	0.9872	0.9683	0.9041	0.7579	0.5036	0.2926	0.3246	0.6420	0.9193	0.9841	0.9944	(89)
MIT 2	18.6390	18.8286	19.2182	19.6812	19.9827	20.1007	20.1101	20.1097	20.0688	19.7136	19.1124	18.6166	(90)
Living area fraction	18.7741	18.9586	19.3382	19.7902	20.0876	20.2065	20.2170	20.2166	fLA = Living area / (4) =	19.8213	19.2341	18.7518	(91)
MIT	18.7741	18.9586	19.3382	19.7902	20.0876	20.2065	20.2170	20.2166	20.1737	19.8213	19.2341	18.7518	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7741	18.9586	19.3382	19.7902	20.0876	20.2065	20.2170	20.2166	20.1737	19.8213	19.2341	18.7518	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9896	0.9824	0.9605	0.8950	0.7568	0.5127	0.3045	0.3371	0.6487	0.9106	0.9788	0.9916	(94)
Useful gains	927.3439	1026.4803	1098.6203	1133.5264	989.1875	674.8373	380.3868	393.9473	706.0327	901.4064	897.0293	879.3583	(95)
Ext temp.	4.5000	4.9000	6.8000	9.3000	12.3000	15.3000	17.5000	17.4000	14.9000	11.2000	7.4000	4.5000	(96)
Heat loss rate W	2062.6792	2020.3142	1796.9816	1484.4986	1099.4345	686.4847	380.9720	394.9294	742.7945	1223.0038	1678.7696	2037.1813	(97)
Space heating kWh	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203	(98a)
Space heating requirement - total per year (kWh/year)												4030.3921	
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	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4030.3921	
Space heating per m2										(98c) / (4) =		27.8073	(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 %)													88.1000	(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	844.6894	667.8564	519.5808	252.7000	82.0238	0.0000	0.0000	0.0000	0.0000	239.2685	562.8530	861.4203	(98)	
Space heating efficiency (main heating system 1)	88.1000	88.1000	88.1000	88.1000	88.1000	0.0000	0.0000	0.0000	0.0000	88.1000	88.1000	88.1000	(210)	
Space heating fuel (main heating system)	958.7848	758.0662	589.7626	286.8331	93.1030	0.0000	0.0000	0.0000	0.0000	271.5874	638.8797	977.7755	(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	287.7441	254.3794	269.8655	236.1989	228.2729	204.9279	201.6162	209.9966	212.7310	238.1462	254.3924	284.4463	(64)	
Efficiency of water heater	85.7432	85.5474	84.9583	83.7244	81.6057	79.5000	79.5000	79.5000	79.5000	83.5894	85.2300	85.7961	(217)	
Fuel for water heating, kWh/month	335.5883	297.3548	317.6445	282.1149	279.7266	257.7709	253.6053	264.1467	267.5862	284.8999	298.4774	331.5376	(219)	
Space cooling fuel requirement	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	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)	
Electricity generated by PVs (Appendix M) (negative quantity)	-38.8218	-52.9022	-78.4686	-94.3939	-101.9679	-98.8254	-96.9240	-90.6668	-79.2456	-64.5782	-44.0545	-33.0761	(233a)	
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												4574.7924	(211)	
Space heating fuel - main system 2												0.0000	(213)	
Space heating fuel - secondary												0.0000	(215)	
Efficiency of water heater												79.5000		
Water heating fuel used												3470.4529	(219)	
Space cooling fuel												0.0000	(221)	
Electricity for pumps and fans:														
central heating pump												41.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												86.0000	(231)	
Electricity for lighting (calculated in Appendix L)												263.3572	(232)	
Energy saving/generation technologies (Appendices M, N and Q)														
PV generation												-873.9247	(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												7520.6778	(238)	

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4574.7924	5.6000	256.1884	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3470.4529	5.6000	194.3454	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	86.0000	26.0600	22.4116	(249)
Energy for lighting	263.3572	26.0600	68.6309	(250)
Additional standing charges			99.0000	(251)

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Energy saving/generation technologies			
PV Unit electricity used in dwelling	-873.9247	26.0600	-227.7448
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-227.7448 (252)
Total energy cost			412.8314 (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	4574.7924	0.2100	960.7064 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3470.4529	0.2100	728.7951 (264)
Space and water heating			1689.5015 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-873.9247	0.1339	-117.0226
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-117.0226 (269)
Total CO2, kg/year			1622.4188 (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	4574.7924	1.1300	5169.5155 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3470.4529	1.1300	3921.6118 (278)
Space and water heating			9091.1272 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	263.3572	1.5338	403.9460 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-873.9247	1.4948	-1306.3789
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-1306.3789 (283)
Total Primary energy kWh/year			8318.7951 (286)

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Property Reference	Crescent Terrace	Issued on Date	04/04/2025
Assessment Reference	Crescent Terrace	Prop Type Ref	Aspen Semi-Detached
Property	House Type A, 1, Leywood close, Braintree, Essex, CM7 3NP		
SAP Rating	84 B	DER	3.39
Environmental	97 A	% DER < TER	66.13
CO ₂ Emissions (t/year)	0.45	DFEE	35.94
Compliance Check	See BREL	TFEE	39.24
% DPER < TPER	33.57	DFEE < TFEE	8.41
		DPER	34.78
		TPER	52.36
Assessor Details		Assessor ID	W281-0001
Client	Chase new homes, Chase new homes		

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (4) (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0822 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3322 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (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	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3322	0.3571	0.3737	0.3903 (22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m ²)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	31416.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.7571 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9700	0.0260	0.3372	

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E3 Sill	7.5700	0.0230	0.1741
E4 Jamb	33.6900	0.0180	0.6064
E5 Ground floor (normal)	23.8198	0.0730	1.7388
E6 Intermediate floor within a dwelling	10.7210	0.0010	0.0107
E20 Exposed floor (normal)	5.3243	0.0470	0.2502
E21 Exposed floor (inverted)	13.0920	0.3200	4.1895
P1 Party wall - Ground floor	14.1428	0.0580	0.8203
P2 Party wall - Intermediate floor within a dwelling	14.1428	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	21.5927	0.0330	0.7126
E10 Eaves (insulation at ceiling level)	16.0454	0.0550	0.8825
E16 Corner (normal)	4.8000	0.0400	0.1920
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936
E18 Party wall between dwellings	20.0000	0.0320	0.6400
P7 Party Wall - Exposed floor (normal)	7.4499	0.4800	3.5759
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.7367 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	71.0576	70.6379	70.2266	68.2947	67.9333	66.2507	66.2507	65.9391	66.8988	67.9333	68.6645	69.4289 (38)
Average = Sum(39)m / 12 =	145.3355	144.9159	144.5046	142.5727	142.2112	140.5286	140.5286	140.2170	141.1767	142.2112	142.9424	143.7069 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (42)
Hot water usage for mixer showers	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978 (42a)
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												137.4320 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210 (44)
Distribution loss (46)m = 0.15 x (45)m	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874 (45)
Water storage loss:												Total = Sum(45)m = 2282.7173
Store volume	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231 (46)
a) If manufacturer declared loss factor is known (kWh/day):												200.0000 (47)
Temperature factor from Table 2b												1.8000 (48)
Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												0.9720 (55)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (56)
Primary loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (57)
Combi 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)
Total heat required for water heating calculated for each month	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)
WWHRS	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818 (62)
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 (63a)
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 (63b)
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 (63c)
Output from w/h	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)
12Total per year (kWh/year)	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818 (64)
Electric shower(s)												Total per year (kWh/year) = Sum(64)m = 2911.3933 (64)
	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)
												0.0000 (64a)
Heat gains from water heating, kWh/month	121.4466	107.8588	115.5019	103.4765	101.6724	93.0789	92.8091	95.5956	95.6734	104.9553	109.5258	120.3501 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	186.8621	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	163.2347	160.5042	155.2446	143.7173	136.6565	129.2762	124.7434	128.4887	132.8797	141.0689	152.1192	161.7609 (72)
Total internal gains	713.8648	732.4861	700.9070	677.4721	642.6523	620.0960	596.0403	596.5172	614.7703	634.8672	673.6764	698.4941 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.9200	10.6334	0.7200	0.7000	0.7700	51.6981 (74)

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South		7.3100				46.7521				0.7200				0.7000				0.7700				119.3664 (78)			
Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416	83												
Total gains	884.9293	1026.7752	1117.8098	1228.5810	1299.1965	1291.2225	1234.8815	1152.3795	1076.7505	963.3288	878.9426	844.7357	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	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269	
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485	
util living area	0.9959	0.9908	0.9797	0.9412	0.8432	0.6596	0.4935	0.5469	0.7920	0.9576	0.9910	0.9968	86
Living	19.6830	19.8782	20.1468	20.5135	20.8056	20.9591	20.9923	20.9874	20.8960	20.5237	20.0460	19.6572	
Non living	18.5359	18.7864	19.1283	19.5901	19.9270	20.0831	20.1059	20.1053	20.0292	19.6112	19.0097	18.5098	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	87
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904	88
util rest of house	0.9947	0.9882	0.9737	0.9235	0.7988	0.5814	0.3971	0.4473	0.7233	0.9412	0.9880	0.9958	89
MIT 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904	90
Living area fraction									FLA = Living area / (4) =				
MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000	92
Temperature adjustment												0.0000	
adjusted MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000	93

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9949	0.9886	0.9745	0.9259	0.8047	0.5913	0.4090	0.4597	0.7324	0.9435	0.9884	0.9960	94
Useful gains	880.4212	1015.0319	1089.3545	1137.6028	1045.4388	763.5450	505.0404	529.7296	788.6424	908.8979	868.7746	841.3205	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	2309.6366	2216.3261	1979.1289	1611.8909	1209.8738	789.2275	508.1703	535.3093	862.9905	1366.3062	1873.0996	2299.3101	97
Space heating kWh	1063.3363	807.2697	661.9922	341.4875	122.3397	0.0000	0.0000	0.0000	0.0000	340.3118	723.1140	1084.7443	98a
Space heating requirement - total per year (kWh/year)												5144.5953	
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	1063.3363	807.2697	661.9922	341.4875	122.3397	0.0000	0.0000	0.0000	0.0000	340.3118	723.1140	1084.7443	98c
Space heating requirement after solar contribution - total per year (kWh/year)												5144.5953	
Space heating per m2												35.4947	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 %)													288.6310 (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	1063.3363	807.2697	661.9922	341.4875	122.3397	0.0000	0.0000	0.0000	0.0000	340.3118	723.1140	1084.7443	98
Space heating efficiency (main heating system 1)	288.6310	288.6310	288.6310	288.6310	288.6310	0.0000	0.0000	0.0000	0.0000	288.6310	288.6310	288.6310	210
Space heating fuel (main heating system)	368.4069	279.6892	229.3559	118.3128	42.3862	0.0000	0.0000	0.0000	0.0000	117.9055	250.5324	375.8239	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	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818	64
Efficiency of water heater (217)m	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	216
Fuel for water heating, kWh/month	257.9374	228.0704	242.0453	212.0496	205.0742	184.2532	181.3793	188.8285	191.1893	213.8504	228.2216	255.0060	219
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	221
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	231
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	232
Electricity generated by PVs (Appendix M) (negative quantity)	-61.9103	-91.9021	-137.6212	-156.7641	-167.6621	-152.8940	-150.7058	-140.8696	-122.4859	-104.1529	-69.0495	-53.0285	233a
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												1782.4128	211
Space heating fuel - main system 2												0.0000	213

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Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	112.5000
Water heating fuel used	2587.9051 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
Total electricity for the above, kWh/year	0.0000 (231)
Electricity for lighting (calculated in Appendix L)	263.3572 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
FV generation	-1409.0459 (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	3224.6292 (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	1782.4128	0.1557	277.5306 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2587.9051	0.1410	364.7893 (264)
Space and water heating			642.3199 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Energy saving/generation technologies			
FV Unit electricity used in dwelling	-1409.0459	0.1344	-189.4316
FV Unit electricity exported	0.0000	0.0000	0.0000
Total			-189.4316 (269)
Total CO2, kg/year			490.8989 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			3.3900 (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	1782.4128	1.5765	2809.8905 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2587.9051	1.5212	3936.7716 (278)
Space and water heating			6746.6621 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	263.3572	1.5338	403.9460 (282)
Energy saving/generation technologies			
FV Unit electricity used in dwelling	-1409.0459	1.4969	-2109.1619
FV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2109.1619 (283)
Total Primary energy kWh/year			5041.4462 (286)
Dwelling Primary energy Rate (DPER)			34.7800 (287)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1095 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3595 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)

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Infiltration rate adjusted to include shelter factor

$$(21) = (18) \times (20) = 0.3595 \quad (21)$$

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)
Adj infilt rate	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)
Effective ac	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225	(22b)
	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
TER Opaque door			1.8900	1.0000	1.8900		(26)
TER Opening Type			21.2300	1.1450	24.3092		(27)
Heatloss Floor 1			58.4200	0.1300	7.5946		(28a)
Heatloss Floor 2			28.0900	0.1300	3.6517		(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1800	13.9770		(29a)
External Roof 1	86.5200		86.5200	0.1100	9.5172		(30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.9397		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000		(32)

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

216.7571 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	12.9700	0.0500	0.6485
E3 Sill	7.5700	0.0500	0.3785
E4 Jamb	33.6900	0.0500	1.6845
E5 Ground floor (normal)	23.8198	0.1600	3.8112
E6 Intermediate floor within a dwelling	10.7210	0.0000	0.0000
E20 Exposed floor (normal)	5.3243	0.3200	1.7038
E21 Exposed floor (inverted)	13.0920	0.3200	4.1895
P1 Party wall - Ground floor	14.1428	0.0800	1.1314
P2 Party wall - Intermediate floor within a dwelling	14.1428	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	21.5927	0.1200	2.5911
E10 Eaves (insulation at ceiling level)	16.0454	0.0600	0.9627
E16 Corner (normal)	4.8000	0.0900	0.4320
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0900	-0.4320
E18 Party wall between dwellings	20.0000	0.0600	1.2000
P7 Party Wall - Exposed floor (normal)	7.4499	0.1600	1.1920

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

19.4932 (36)

Point Thermal Bridges

$$(33) + (36) + (36a) = 80.4328 \quad (37)$$

Total fabric heat loss

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047	(38)
Average = Sum(39)m / 12 =	153.3457	152.8540	152.3721	150.1085	149.6850	147.7135	147.7135	147.3484	148.4729	149.6850	150.5418	151.4375	(39)
												150.1065	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0580	1.0546	1.0513	1.0357	1.0327	1.0191	1.0191	1.0166	1.0244	1.0327	1.0386	1.0448	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
Hot water usage for baths	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	(42a)
Hot water usage for other uses	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	(42b)
Average daily hot water use (litres/day)	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	(42c)
												137.4320	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)
Energy content (annual)	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Distribution loss (46)m = 0.15 x (45)m	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage													
Primary loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Combi 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)
Comb 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													
WWHRS	287.7113	254.3497	269.8326	236.1671	228.2401	204.8961	201.5834	209.9638	212.6992	238.1134	254.3606	284.4135	(62)
PV diverter	-33.4999	-29.6276	-31.0243	-25.6893	-23.9415	-20.4869	-19.2032	-20.4207	-21.1966	-24.9884	-28.3089	-32.8795	(63a)
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	(63b)
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	(63c)
Output from w/h	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)
12Total per year (kWh/year)	254.2114	224.7222	238.8083	210.4777	204.2986	184.4092	182.3801	189.5431	191.5026	213.1249	226.0517	251.5339	(64)
Electric shower(s)												2571.0638	(64)
												2571	(64)
Heat gains from water heating, kWh/month													
	119.4719	106.0752	113.5273	101.5655	99.6978	91.1679	90.8344	93.6209	93.7624	102.9806	107.6148	118.3754	(65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	160.5806	157.8501	152.5904	141.0632	134.0024	126.6221	122.0893	125.8345	130.2256	138.4148	149.4651	159.1067 (72)
Total internal gains	714.2107	732.8320	701.2529	677.8180	642.9982	617.4419	593.3862	593.8631	612.1162	635.2131	674.0223	698.8399 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			13.9200	10.6334	0.6300	0.7000	0.7700	45.2359 (74)				
South			7.3100	46.7521	0.6300	0.7000	0.7700	104.4456 (78)				
Solar gains	149.6814	257.5030	364.7900	482.2203	574.4762	558.9861	486.3795	404.2327	287.4039	179.6079	127.9614 (83)	
Total gains	863.8922	990.3349	1066.0429	1160.0383	1217.4743	1204.6776	1152.3722	1080.2426	1016.3489	922.6170	853.6302	826.8014 (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, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.9099	57.0929	57.2735	58.1371	58.3016	59.0798	59.0798	59.2262	58.7776	58.3016	57.9698	57.6270
alpha	4.7940	4.8062	4.8182	4.8758	4.8868	4.9387	4.9387	4.9484	4.9185	4.8868	4.8647	4.8418
util living area	0.9964	0.9924	0.9843	0.9563	0.8806	0.7179	0.5490	0.6026	0.8343	0.9669	0.9924	0.9971 (86)
MIT	19.5681	19.7542	20.0216	20.4018	20.7291	20.9316	20.9853	20.9772	20.8503	20.4372	19.9469	19.5476 (87)
Th 2	20.0353	20.0381	20.0408	20.0537	20.0561	20.0674	20.0674	20.0695	20.0631	20.0561	20.0513	20.0461 (88)
util rest of house	0.9953	0.9902	0.9795	0.9419	0.8411	0.6366	0.4399	0.4923	0.7691	0.9532	0.9898	0.9962 (89)
MIT 2	18.3568	18.5962	18.9379	19.4223	19.8098	20.0230	20.0617	20.0598	19.9502	19.4738	18.8524	18.3382 (90)
Living area fraction	18.5027	18.7357	19.0685	19.5403	19.9205	20.1325	20.1730	20.1703	20.0586	19.5899	18.9843	18.4839 (91)
MIT	18.5027	18.7357	19.0685	19.5403	19.9205	20.1325	20.1730	20.1703	20.0586	19.5899	18.9843	18.4839 (92)
Temperature adjustment	18.5027	18.7357	19.0685	19.5403	19.9205	20.1325	20.1730	20.1703	20.0586	19.5899	18.9843	18.4839 (93)
adjusted MIT	18.5027	18.7357	19.0685	19.5403	19.9205	20.1325	20.1730	20.1703	20.0586	19.5899	18.9843	18.4839 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9928	0.9860	0.9727	0.9321	0.8345	0.6427	0.4527	0.5048	0.7687	0.9442	0.9855	0.9941 (94)
Useful gains	857.6707	976.4294	1036.9819	1081.2333	1015.9968	774.2653	521.6706	545.3030	781.2677	871.1765	841.2691	821.9317 (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	2177.9213	2114.8356	1915.0835	1597.1926	1230.4929	817.2231	527.7768	555.5452	884.6929	1345.6513	1789.0805	2163.1129 (97)
Space heating kWh	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (98a)
Space heating requirement - total per year (kWh/year)	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (98a)
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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Space heating kWh	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (98c)
Space heating per m ²	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (98c)
	(98c) / (4) =											34.2551 (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	982.2664	765.0090	653.3076	371.4907	159.5851	0.0000	0.0000	0.0000	0.0000	353.0093	682.4242	997.8388 (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)	1064.2107	828.8288	707.8089	402.4818	172.8983	0.0000	0.0000	0.0000	0.0000	382.4586	739.3545	1081.0821 (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

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Efficiency of water heater (217)m	254.2114	224.7222	238.8083	210.4777	204.2986	184.4092	182.3801	189.5431	191.5026	213.1249	226.0517	251.5339 (64)
Fuel for water heating, kWh/month	86.7876	86.5828	86.1977	85.3199	83.5120	79.8000	79.8000	79.8000	79.8000	85.1833	86.3760	79.8000 (216)
Space cooling fuel requirement (221)m	292.9120	259.5459	277.0473	246.6926	244.6338	231.0892	228.5465	237.5226	239.9782	250.1956	261.7066	289.6907 (219)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Lighting	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685	7.3041	7.0685 (231)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	35.0689	28.1335	25.3311	18.5587	14.3353	11.7120	13.0771	16.9981	22.0789	28.9687	32.7200	36.0435 (232)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	-53.9613	-75.7118	-108.2718	-121.0258	-129.8111	-120.8054	-119.2102	-112.8309	-101.5442	-86.1488	-59.1557	-46.6868 (233a)
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 (234a)
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 (235a)
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 (235c)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	-31.5771	-66.3098	-131.6235	-197.4818	-260.9804	-262.2740	-259.2865	-219.6830	-161.1463	-94.8759	-42.1654	-24.9875 (233b)
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 (234b)
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 (235b)
Annual totals kWh/year	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)
Space heating fuel - main system 1												5379.1237 (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												3059.5609 (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)												283.0258 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2887.5549 (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												5920.1556 (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	5379.1237	0.2100	1129.6160 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3059.5609	0.2100	642.5078 (264)
Space and water heating			1772.1238 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	283.0258	0.1443	40.8494 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1135.1636	0.1347	-152.9300
PV Unit electricity exported	-1752.3912	0.1259	-220.6567
Total			-373.5867 (269)
Total CO2, kg/year			1451.3157 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0100 (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	5379.1237	1.1300	6078.4097 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3059.5609	1.1300	3457.3038 (278)
Space and water heating			9535.7136 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	283.0258	1.5338	434.1145 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1135.1636	1.4979	-1700.3760
PV Unit electricity exported	-1752.3912	0.4622	-809.9619
Total			-2510.3379 (283)
Total Primary energy kWh/year			7589.5910 (286)
Target Primary Energy Rate (TPER)			52.3600 (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)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (5)

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2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												4 * 10 = 40.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =										40.0000 / (5) =	0.1095 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												5.0000 (17)
Infiltration rate												0.3595 (18)
Number of sides sheltered												0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.3595 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225 (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	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								(27)
Window			21.2300	1.1450	24.3092			(26)
Front Door			1.8900	1.2000	2.2680			(28a)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000	(28b)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000	(29a)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000	(30)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800	(31)
Total net area of external elements Aum(A, m2)			273.8000					(32)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.5413			(33)
Main dwelling								
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000	(32)
Ground Floor			59.5600			9.0000	536.0400	(32c)
1st Floor			173.9100			9.0000	1565.1900	(32c)
Internal Floor 1			58.4200			18.0000	1051.5600	(32d)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =	31416.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								216.7571 (35)
List of Thermal Bridges								
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				12.9700	0.0260		0.3372	
E3 Sill				7.5700	0.0230		0.1741	
E4 Jamb				33.6900	0.0180		0.6064	
E5 Ground floor (normal)				23.8198	0.0730		1.7388	
E6 Intermediate floor within a dwelling				10.7210	0.0010		0.0107	
E20 Exposed floor (normal)				5.3243	0.0470		0.2502	
E21 Exposed floor (inverted)				13.0920	0.3200		4.1895	
P1 Party wall - Ground floor				14.1428	0.0580		0.8203	
P2 Party wall - Intermediate floor within a dwelling				14.1428	0.0000		0.0000	
P4 Party wall - Roof (insulation at ceiling level)				21.5927	0.0330		0.7126	
E10 Eaves (insulation at ceiling level)				16.0454	0.0550		0.8825	
E16 Corner (normal)				4.8000	0.0400		0.1920	
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0820		-0.3936	
E18 Party wall between dwellings				20.0000	0.0320		0.6400	
P7 Party Wall - Exposed floor (normal)				7.4499	0.4800		3.5759	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							(36a) =	13.7367 (36)
Point Thermal bridges								0.0000
Total fabric heat loss							(33) + (36) + (36a) =	74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047 (38)
Average = Sum(39)m / 12 =	147.1908	146.6992	146.2172	143.9536	143.5301	141.5586	141.5586	141.1935	142.3180	143.5301	144.3869	145.2826 (39)
												143.9516
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0155	1.0121	1.0088	0.9932	0.9903	0.9767	0.9767	0.9742	0.9819	0.9903	0.9962	1.0024 (40)
Days in mont.	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9260 (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	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												69.8717 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.2301	74.1387	71.8554	69.0139	66.4788	63.8443	63.2972	65.5758	67.9128	70.6182	73.4849	76.1232	(44)
Energy content (annual)	120.7299	105.5725	110.4391	94.4766	89.4933	78.5040	76.5525	81.1966	83.7433	95.8283	104.6927	119.1905	(45)
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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119	(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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119	(64)
12Total per year (kWh/year)													
Electric shower(s)	58.6839	52.2878	57.0963	54.4863	55.5087	52.9499	54.7149	55.5087	54.4863	57.0963	56.0227	58.6839	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												986.3563	(64)
Heat gains from water heating, kWh/month	40.3261	35.5061	37.7424	33.6978	32.8945	29.9196	29.9461	31.1315	31.4170	34.6376	36.2529	39.9990	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	186.8621	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	(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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)	54.2017	52.8365	50.7290	46.8026	44.2130	41.5550	40.2502	41.8434	43.6348	46.5559	50.3512	53.7620	(72)
Total internal gains	604.8319	624.8184	596.3915	580.5573	550.2088	532.3748	511.5471	509.8719	525.5254	540.3541	571.9084	590.4952	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF				Access factor Table 6d			Gains W
North					13.9200	10.6334	0.7200		0.7000				0.7700			51.6981 (74)
South					7.3100	46.7521	0.7200		0.7000				0.7700			119.3664 (78)
Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661					146.2416 (83)
Total gains	775.8964	919.1075	1013.2943	1131.6663	1206.7530	1203.5013	1150.3883	1065.7342	987.5055	868.8157	777.1746					736.7369 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	59.2896	59.4883	59.6844	60.6229	60.8017	61.6485	61.6485	61.8079	61.3196	60.8017	60.4409	60.0683	
alpha	4.9526	4.9659	4.9790	5.0415	5.0534	5.1099	5.1099	5.1205	5.0880	5.0534	5.0294	5.0046	
util living area	0.9977	0.9944	0.9866	0.9570	0.8739	0.6998	0.5304	0.5896	0.8334	0.9718	0.9948	0.9983	(86)
MIT	19.5691	19.7688	20.0466	20.4375	20.7606	20.9454	20.9891	20.9819	20.8639	20.4461	19.9473	19.5470	(87)
Th 2	20.0704	20.0732	20.0760	20.0890	20.0914	20.1028	20.1028	20.1049	20.0984	20.0914	20.0865	20.0814	(88)
util rest of house	0.9971	0.9927	0.9825	0.9431	0.8340	0.6207	0.4277	0.4842	0.7695	0.9601	0.9930	0.9977	(89)
MIT 2	18.7553	18.9563	19.2340	19.6251	19.9223	20.0754	20.0995	20.0989	20.0182	19.6402	19.1451	18.7417	(90)
Living area fraction	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387	(91)
MIT	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8534	19.0542	19.3319	19.7229	20.0233	20.1802	20.2067	20.2053	20.1201	19.7373	19.2418	18.8387	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9958	0.9902	0.9780	0.9361	0.8306	0.6280	0.4399	0.4965	0.7713	0.9541	0.9906	0.9967	(94)
Useful gains	772.6515	910.0873	991.0432	1059.4084	1002.2887	755.7457	506.0539	529.1663	761.6145	828.9139	769.8881	734.3422	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2142.1217	2076.4070	1876.2431	1557.9996	1194.6432	789.9268	510.5573	537.2773	856.7617	1311.4813	1753.1132	2126.7514	(97)
Space heating kWh	1018.8858	783.7668	658.5887	358.9857	143.1117	0.0000	0.0000	0.0000	0.0000	359.0301	707.9221	1035.9524	(98a)
Space heating requirement - total per year (kWh/year)												5066.2434	
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	1018.8858	783.7668	658.5887	358.9857	143.1117	0.0000	0.0000	0.0000	0.0000	359.0301	707.9221	1035.9524	(98c)

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Space heating requirement after solar contribution - total per year (kWh/year)
Space heating per m2

5066.2434
(98c) / (4) = 34.9541 (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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1330.6511	1047.5338	1073.0708	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8352	0.9050	0.8715	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1111.4106	948.0263	935.1877	0.0000	0.0000	0.0000	0.0000 (102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1327.1835	1268.5903	1173.1014	0.0000	0.0000	0.0000	0.0000 (103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	155.3565	238.4996	177.0078	0.0000	0.0000	0.0000	0.0000 (104)
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 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.8391	59.6249	44.2519	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												142.7160 (107)
Energy for space heating												34.9541 (99)
Energy for space cooling												0.9847 (108)
Total												35.9387 (109)
Fabric Energy Efficiency (DFEE)												35.9 (109)

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.1600 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.1095 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3595 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3595 (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	0.4584	0.4494	0.4404	0.3955	0.3865	0.3416	0.3416	0.3326	0.3595	0.3865	0.4045	0.4225 (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	0.6051	0.6010	0.5970	0.5782	0.5747	0.5583	0.5583	0.5553	0.5646	0.5747	0.5818	0.5892 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
IER Opaque door			1.8900	1.0000	1.8900		(26)
IER Opening Type			21.2300	1.1450	24.3092		(27)
Heatloss Floor 1			58.4200	0.1300	7.5946		(28a)
Heatloss Floor 2			28.0900	0.1300	3.6517		(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1800	13.9770		(29a)
External Roof 1	86.5200		86.5200	0.1100	9.5172		(30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	60.9397	(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000		(32)
Thermal mass parameter (IMP = Cm / TFA) in kJ/m2K							216.7571 (35)

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List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	12.9700	0.0500	0.6485
E2 Other lintels (including other steel lintels)	7.5700	0.0500	0.3785
E3 Sill	33.6900	0.0500	1.6845
E4 Jamb	23.8198	0.1600	3.8112
E5 Ground floor (normal)	10.7210	0.0000	0.0000
E6 Intermediate floor within a dwelling	5.3243	0.3200	1.7038
E20 Exposed floor (normal)	13.0920	0.3200	4.1895
E21 Exposed floor (inverted)	14.1428	0.0800	1.1314
P1 Party wall - Ground floor	14.1428	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling	21.5927	0.1200	2.5911
P4 Party wall - Roof (insulation at ceiling level)	16.0454	0.0600	0.9627
E10 Eaves (insulation at ceiling level)	4.8000	0.0900	0.4320
E16 Corner (normal)	4.8000	-0.0900	-0.4320
E17 Corner (inverted - internal area greater than external area)	20.0000	0.0600	1.2000
E18 Party wall between dwellings	7.4499	0.1600	1.1920
P7 Party Wall - Exposed floor (normal)			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			19.4932 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	80.4328 (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	72.9129	72.4212	71.9393	69.6757	69.2522	67.2807	67.2807	66.9156	68.0401	69.2522	70.1090	71.0047	(38)
Heat transfer coeff	153.3457	152.8540	152.3721	150.1085	149.6850	147.7135	147.7135	147.3484	148.4729	149.6850	150.5418	151.4375	(39)
Average = Sum(39)m / 12 =												150.1065	
HLP	1.0580	1.0546	1.0513	1.0357	1.0327	1.0191	1.0191	1.0166	1.0244	1.0327	1.0386	1.0448	(40)
HLP (average)												1.0356	
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (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	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	(42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	(42c)
Average daily hot water use (litres/day)												69.8717	(43)
Daily hot water use	76.2301	74.1387	71.8554	69.0139	66.4788	63.8443	63.2972	65.5758	67.9128	70.6182	73.4849	76.1232	(44)
Energy content (annual)	120.7299	105.5725	110.4391	94.4766	89.4933	78.5040	76.5525	81.1966	83.7433	95.8283	104.6927	119.1905	(45)
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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119	(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	102.6204	89.7366	93.8732	80.3051	76.0693	66.7284	65.0696	69.0171	71.1818	81.4540	88.9888	101.3119	(64)
Total per year (kWh/year)												986.3563	(64)
Electric shower(s)	58.6839	52.2878	57.0963	54.4863	55.5087	52.9499	54.7149	55.5087	54.4863	57.0963	56.0227	58.6839	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												667.5259	(64a)
Heat gains from water heating, kWh/month	40.3261	35.5061	37.7424	33.6978	32.8945	29.9196	29.9461	31.1315	31.4170	34.6376	36.2529	39.9990	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	146.2979	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	168.7786	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	168.7786	174.4046	168.7786	174.4046	168.7786	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	314.9622	318.2305	309.9944	292.4608	270.3278	249.5259	235.6289	232.3606	240.5966	258.1302	280.2633	301.0652	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	37.6298	(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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)	54.2017	52.8365	50.7290	46.8026	44.2130	41.5550	40.2502	41.8434	43.6348	46.5559	50.3512	53.7620	(72)
Total internal gains	604.8319	624.8184	596.3915	580.5573	550.2088	532.3748	511.5471	509.8719	525.5254	540.3541	571.9084	590.4952	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	13.9200	10.6334	0.6300	0.7000	0.7700	45.2359 (74)
South	7.3100	46.7521	0.6300	0.7000	0.7700	104.4456 (78)

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Solar gains	149.6814	257.5030	364.7900	482.2203	574.4762	587.2357	558.9861	486.3795	404.2327	287.4039	179.6079	127.9614 (83)
Total gains	754.5133	882.3214	961.1814	1062.7777	1124.6850	1119.6105	1070.5332	996.2514	929.7580	827.7580	751.5163	718.4567 (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	56.9099	57.0929	57.2735	58.1371	58.3016	59.0798	59.0798	59.2262	58.7776	58.3016	57.9698	57.6270
alpha	4.7940	4.8062	4.8182	4.8758	4.8868	4.9387	4.9387	4.9484	4.9185	4.8868	4.8647	4.8418
util living area	0.9980	0.9954	0.9897	0.9682	0.9053	0.7545	0.5857	0.6444	0.8687	0.9781	0.9956	0.9984 (86)
MIT	19.4773	19.6660	19.9389	20.3338	20.6834	20.9145	20.9806	20.9696	20.8161	20.3674	19.8632	19.4571 (87)
Th 2	20.0353	20.0381	20.0408	20.0537	20.0561	20.0674	20.0674	20.0695	20.0631	20.0561	20.0513	20.0461 (88)
util rest of house	0.9974	0.9940	0.9864	0.9572	0.8710	0.6746	0.4718	0.5303	0.8101	0.9685	0.9940	0.9980 (89)
MIT 2	18.6368	18.8270	19.1003	19.4978	19.8266	20.0230	20.0614	20.0590	19.9510	19.5365	19.0342	18.6250 (90)
Living area fraction	18.7381	18.9281	19.2013	19.5985	19.9298	20.1304	20.1721	20.1687	20.0552	19.6366	19.1341	0.1205 (91)
MIT	18.7381	18.9281	19.2013	19.5985	19.9298	20.1304	20.1721	20.1687	20.0552	19.6366	19.1341	18.7252 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7381	18.9281	19.2013	19.5985	19.9298	20.1304	20.1721	20.1687	20.0552	19.6366	19.1341	18.7252 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9962	0.9917	0.9824	0.9504	0.8656	0.6805	0.4852	0.5433	0.8095	0.9627	0.9919	0.9970 (94)
Useful gains	751.6539	875.0033	944.2907	1010.0937	973.4966	761.8789	519.3977	541.2490	752.6313	796.9015	745.3959	716.3069 (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	2214.0158	2144.2454	1935.3225	1605.9400	1231.8742	816.9081	527.6501	555.3135	884.1826	1352.6393	1811.6316	2199.6668 (97)
Space heating kWh	1087.9973	852.9307	737.3276	429.0094	192.2329	0.0000	0.0000	0.0000	0.0000	413.4689	767.6897	1103.6198 (98a)
Space heating requirement - total per year (kWh/year)												5584.2764
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	1087.9973	852.9307	737.3276	429.0094	192.2329	0.0000	0.0000	0.0000	0.0000	413.4689	767.6897	1103.6198 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5584.2764
Space heating per m2												(98c) / (4) = 38.5282 (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	1388.5069	1093.0799	1119.8479	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7772	0.8603	0.8212	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1079.1674	940.3310	919.6176	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1229.1293	1175.2531	1091.8877	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000		0.0000	0.0000	0.0000	107.9726	174.7821	128.1690	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	26.9932	43.6955	32.0422	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												102.7309 (107)
Energy for space heating												38.5282 (99)
Energy for space cooling												0.7088 (108)
Total												39.2370 (109)
Fabric Energy Efficiency (TFEE)												39.2 (109)

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

1. Overall dwelling characteristics

Main dwelling	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (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)

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Number of flues attached to solid fuel boiler
 Number of flues attached to other heater
 Number of blocked chimneys
 Number of intermittent extract fans
 Number of passive vents
 Number of flueless gas fires

0 * 20 = 0.0000 (6d)
 0 * 35 = 0.0000 (6e)
 0 * 20 = 0.0000 (6f)
 3 * 10 = 30.0000 (7a)
 0 * 10 = 0.0000 (7b)
 0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
 Pressure test
 Pressure Test Method
 Measured/design AP50
 Infiltration rate
 Number of sides sheltered

Air changes per hour
 30.0000 / (5) = 0.0822 (8)
 Yes
 Blower Door
 5.0000 (17)
 0.3322 (18)
 0 (19)
 (20) = 1 - [0.075 x (19)] = 1.0000 (20)
 (21) = (18) x (20) = 0.3322 (21)

Shelter factor
 Infiltration rate adjusted to include shelter factor

	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	0.4235	0.4152	0.4069	0.3654	0.3571	0.3155	0.3155	0.3072	0.3322	0.3571	0.3737	0.3903	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5667	0.5637	0.5498	0.5498	0.5472	0.5552	0.5637	0.5698	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			21.2300	1.1450	24.3092			(27)
Front Door			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000	(28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000	(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000	(29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800	(30)
Total net area of external elements Aum(A, m2)			273.8000					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	60.5413		(33)
Main dwelling								
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000	(32)
Ground Floor			59.5600			9.0000	536.0400	(32c)
1st Floor			173.9100			9.0000	1565.1900	(32c)
Internal Floor 1			58.4200			18.0000	1051.5600	(32d)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
 (28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)
 216.7571 (35)

List of Thermal Bridges

	Length	Psi-value	Total	
K1 Element	12.9700	0.0260	0.3372	
E2 Other lintels (including other steel lintels)	7.5700	0.0230	0.1741	
E3 Sill	33.6900	0.0180	0.6064	
E4 Jamb	23.8198	0.0730	1.7388	
E5 Ground floor (normal)	10.7210	0.0010	0.0107	
E6 Intermediate floor within a dwelling	5.3243	0.0470	0.2502	
E20 Exposed floor (normal)	13.0920	0.3200	4.1895	
E21 Exposed floor (inverted)	14.1428	0.0580	0.8203	
P1 Party wall - Ground floor	14.1428	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	21.5927	0.0330	0.7126	
P4 Party wall - Roof (insulation at ceiling level)	16.0454	0.0550	0.8825	
E10 Eaves (insulation at ceiling level)	4.8000	0.0400	0.1920	
E16 Corner (normal)	4.8000	0.0820	0.3936	
E17 Corner (inverted internal area greater than external area)	20.0000	0.0320	0.6400	
E18 Party wall between dwellings	7.4499	0.4800	3.5759	
P7 Party Wall - Exposed floor (normal)				

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Point Thermal bridges
 Total fabric heat loss
 (33) + (36) + (36a) = 74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	71.0576	70.6379	70.2266	68.2947	67.9333	66.2507	66.2507	65.9391	66.8988	67.9333	68.6645	69.4289	(38)
Average = Sum(39)m / 12 =	145.3355	144.9159	144.5046	142.5727	142.2112	140.5286	140.5286	140.2170	141.1767	142.2112	142.9424	143.7069	(39)
												142.5709	

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	72.9978	(42a)
Hot water usage for baths													
31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	31.5284	(42b)
Hot water usage for other uses													
44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	44.5947	(42c)
Average daily hot water use (litres/day)													137.4320 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	149.1210	(44)
Energy conte	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Energy content (annual)													Total = Sum(45)m = 2282.7173
Distribution loss (46)m = 0.15 x (45)m													
35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	35.0231	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9720 (55)
Total storage loss													
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	(56)

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If cylinder contains dedicated solar storage												
Primary loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	29.1600	30.1320	29.1600	30.1320	(57)
Combi loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
WWHRS	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	(62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Electric shower(s)	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	(64)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	2911.3933											(64a)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
	121.4466	107.8588	115.5019	103.4765	101.6724	93.0789	92.8091	95.5956	95.6734	104.9553	109.5258	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	(68)
Pumps, fans	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Total internal gains	163.2347	160.5042	155.2446	143.7173	136.6565	129.2762	124.7434	128.4887	132.8797	141.0689	152.1192	(72)
	784.6093	782.5885	758.8526	714.6138	669.3712	628.5695	604.3311	607.3667	630.2340	671.1348	720.3669	(73)

6. Solar gains

[Jan]												
	Area				Solar flux		g		FF		Access	Gains
	m2				Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North	13.9200				10.6334		0.7200		0.7000		0.7700	51.6981 (74)
South	7.3100				46.7521		0.7200		0.7000		0.7700	119.3664 (78)
Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416 (83)
Total gains	955.6737	1076.8776	1175.7555	1265.7228	1325.9154	1299.6960	1243.1724	1163.2289	1092.2142	999.5964	925.6330	909.6715 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485
util living area	0.9943	0.9887	0.9752	0.9349	0.8348	0.6561	0.4904	0.5423	0.7853	0.9514	0.9888	0.9955 (86)
Living	19.7416	19.9187	20.1907	20.5365	20.8154	20.9600	20.9925	20.9878	20.9002	20.5481	20.0838	19.7115
Non living	18.6107	18.8375	19.1828	19.6170	19.9366	20.0837	20.1059	20.1055	20.0327	19.6399	19.0573	18.5790
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (88)
util rest of house	0.9927	0.9856	0.9681	0.9158	0.7893	0.5781	0.3946	0.4433	0.7160	0.9332	0.9851	0.9942 (89)
MIT 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (90)
Living area fraction	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000 (91)
MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000 (92)
Temperature adjustment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
adjusted MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9929	0.9860	0.9690	0.9184	0.7953	0.5880	0.4063	0.4556	0.7251	0.9357	0.9856	0.9944 (94)
Ext temp.	948.8630	1061.8470	1139.3369	1162.3776	1054.5159	764.1900	505.1326	529.9521	791.9915	935.3695	912.3153	904.5582 (95)
Heat loss rate W	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)
Space heating kWh	2309.6366	2216.3261	1979.1289	1611.8909	1209.8738	789.2275	508.1703	535.3093	862.9905	1366.3062	1873.0996	2299.3101 (97)
Space heating requirement - total per year (kWh/year)	1012.4156	775.8100	624.8053	323.6496	115.5863	0.0000	0.0000	0.0000	0.0000	320.6169	691.7647	1037.6954 (98a)
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)	1012.4156	775.8100	624.8053	323.6496	115.5863	0.0000	0.0000	0.0000	0.0000	320.6169	691.7647	1037.6954 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	4902.3437											(98c) / (4) =
Space heating per m ²	33.8233											(99)

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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 %)													288.6310 (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	1012.4156	775.8100	624.8053	323.6496	115.5863	0.0000	0.0000	0.0000	0.0000	320.6169	691.7647	1037.6954	(98)
Space heating efficiency (main heating system 1)	288.6310	288.6310	288.6310	288.6310	288.6310	0.0000	0.0000	0.0000	0.0000	288.6310	288.6310	288.6310	(210)
Space heating fuel (main heating system)	350.7647	268.7896	216.4720	112.1327	40.0464	0.0000	0.0000	0.0000	0.0000	111.0819	239.6710	359.5232	(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 requirement	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818	(64)
Efficiency of water heater	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	(216)
Fuel for water heating, kWh/month	257.9374	228.0704	242.0453	212.0496	205.0742	184.2532	181.3793	188.8285	191.1893	213.8504	228.2216	255.0060	(217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-61.7551	-91.6651	-137.0582	-156.2586	-167.3727	-152.8940	-150.7058	-140.8696	-122.4859	-103.8667	-68.8889	-52.9147	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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													1698.4815 (211)
Space heating fuel - main system 2													0.0000 (213)
Space heating fuel - secondary													0.0000 (215)
Efficiency of water heater													112.5000
Water heating fuel used													2587.9051 (219)
Space cooling fuel													0.0000 (221)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													263.3572 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
FV generation													-1406.7353 (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													3143.0086 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1698.4815	16.4900	280.0796	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2587.9051	16.4900	426.7456	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Energy for lighting	263.3572	16.4900	43.4276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
FV Unit electricity used in dwelling	-1406.7353	16.4900	-231.9706	
FV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-231.9706	(252)
Total energy cost			518.2821	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.9823	(257)
SAP value		84.0766	
SAP rating (Section 12)		84	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1698.4815	0.1557	264.5220	(261)

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Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2587.9051	0.1410	364.7893 (264)
Space and water heating			629.3114 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1406.7353	0.1344	-189.0901
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-189.0901 (269)
Total CO2, kg/year			478.2319 (272)
CO2 emissions per m2			3.3000 (273)
EI value			96.6261
EI rating			97 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Main dwelling			
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	3 * 10 = 30.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) = 0.0822 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3322 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3322 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.7000	4.6000	4.1000	4.0000	3.6000	3.7000	3.7000	3.9000	4.2000	4.2000	4.5000 (22)
Wind factor	1.2250	1.1750	1.1500	1.0250	1.0000	0.9000	0.9250	0.9250	0.9750	1.0500	1.0500	1.1250 (22a)
Adj infiltr rate	0.4069	0.3903	0.3820	0.3405	0.3322	0.2989	0.3072	0.3072	0.3239	0.3488	0.3488	0.3737 (22b)
Effective ac	0.5828	0.5762	0.5730	0.5580	0.5552	0.5447	0.5472	0.5472	0.5524	0.5608	0.5608	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m2)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 216.7571 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	12.9700	0.0260	0.3372
E2 Other lintels (including other steel lintels)	7.5700	0.0230	0.1741
E3 Sill	33.6900	0.0180	0.6064
E4 Jamb	23.8198	0.0730	1.7388
E5 Ground floor (normal)	10.7210	0.0010	0.0107
E6 Intermediate floor within a dwelling	5.3243	0.0470	0.2502
E20 Exposed floor (normal)	13.0920	0.3200	4.1895
E21 Exposed floor (inverted)	14.1428	0.0580	0.8203
P1 Party wall - Ground floor	14.1428	0.0000	0.0000
P2 Party wall - Intermediate floor within a dwelling			

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P4 Party wall - Roof (insulation at ceiling level)	21.5927	0.0330	0.7126
E10 Eaves (insulation at ceiling level)	16.0454	0.0550	0.8825
E16 Corner (normal)	4.8000	0.0400	0.1920
E17 Corner (inverted - internal area greater than external area)	4.8000	-0.0820	-0.3936
E18 Party wall between dwellings	20.0000	0.0320	0.6400
P7 Party Wall - Exposed floor (normal)	7.4499	0.4800	3.5759
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.7367 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	74.2779 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	70.2266	69.4289	69.0426	67.2353	66.8988	65.6358	65.9391	65.9391	66.5706	67.5801	67.5801	68.6645	(38)
Average = Sum(39)m / 12 =	144.5046	143.7069	143.3205	141.5132	141.1767	139.9137	140.2170	140.2170	140.8485	141.8581	141.8581	142.9424	(39)
												141.8397	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9970	0.9915	0.9888	0.9764	0.9740	0.9653	0.9674	0.9674	0.9718	0.9787	0.9787	0.9862	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	72.9978	(42a)
Hot water usage for baths													
31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	31.5284	(42b)
Hot water usage for other uses													
44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	44.5947	(42c)
Average daily hot water use (litres/day)													137.4320 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)
Energy content	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	35.0231	(46)
Water storage loss:													
Store volume													200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9720 (55)
Total storage loss													
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	(56)
If cylinder contains dedicated solar storage													
30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	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													
290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818	286.8818	(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	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818	(64)
													2911.3933 (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	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month													
121.4466	107.8588	115.5019	103.4765	101.6724	93.0789	92.8091	95.5956	95.6734	104.9553	109.5258	120.3501	120.3501	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	(66)
37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171	38.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	(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)													
-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)													
163.2347	160.5042	155.2446	143.7173	136.6565	129.2762	124.7434	128.4887	132.8797	141.0689	152.1192	161.7609	161.7609	(72)
Total internal gains													
784.6093	782.5885	758.8526	714.6138	669.3712	628.5695	604.3311	607.3667	630.2340	671.1348	720.3669	763.4299	763.4299	(73)

6. Solar gains

[Jan]												
	Area				Solar flux		g		FF		Access	Gains
	m2				Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
North	13.9200				12.0246		0.7200		0.7000		0.7700	58.4622 (74)
South	7.3100				51.4430		0.7200		0.7000		0.7700	131.3432 (78)
Solar gains	189.8054	299.6057	422.2821	589.1663	675.0350	727.9198	685.2635	601.4045	498.3736	356.0936	233.4191	160.6498 (83)
Total gains	974.4147	1082.1943	1181.1347	1303.7802	1344.4062	1356.4894	1289.5947	1208.7711	1128.6076	1027.2284	953.7860	924.0796 (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	60.3917	60.7269	60.8907	61.6683	61.8153	62.3733	62.2384	62.2384	61.9593	61.5184	61.5184	61.0517
alpha	5.0261	5.0485	5.0594	5.1112	5.1210	5.1582	5.1492	5.1492	5.1306	5.1012	5.1012	5.0701
util living area	0.9934	0.9884	0.9722	0.9184	0.7966	0.5717	0.3789	0.4149	0.7061	0.9338	0.9859	0.9947 (86)
Living	19.7918	19.9376	20.2422	20.6073	20.8652	20.9811	20.9982	20.9972	20.9466	20.6309	20.1532	19.7694
Non living	18.6781	18.8666	19.2524	19.7054	19.9929	20.1021	20.1101	20.1098	20.0736	19.7398	19.1497	18.6562
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948 (88)
util rest of house	0.9915	0.9852	0.9642	0.8951	0.7438	0.4895	0.2835	0.3139	0.6230	0.9091	0.9813	0.9932 (89)
MIT 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948 (90)
Living area fraction												flA = Living area / (4) = 0.1205 (91)
MIT	20.1960	20.2000	20.2020	20.2111	20.2128	20.2193	20.2177	20.2177	20.2145	20.2094	20.2094	20.2039 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1960	20.2000	20.2020	20.2111	20.2128	20.2193	20.2177	20.2177	20.2145	20.2094	20.2094	20.2039 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9918	0.9856	0.9653	0.8983	0.7507	0.4997	0.2951	0.3262	0.6337	0.9126	0.9819	0.9934 (94)
Useful gains	966.4092	1066.6428	1140.1282	1171.1369	1009.2325	677.8717	380.5660	394.2517	715.1877	937.3991	936.5337	918.0122 (95)
Ext temp.	4.5000	4.9000	6.8000	9.3000	12.3000	15.3000	17.5000	17.4000	14.9000	11.2000	7.4000	4.5000 (96)
Heat loss rate W	2268.1381	2198.7152	1920.7753	1544.0692	1117.1086	688.2725	381.0705	395.0922	748.5404	1278.0528	1817.1136	2244.7500 (97)
Space heating kWh	968.4863	760.7527	580.8014	268.5112	80.2598	0.0000	0.0000	0.0000	0.0000	253.4464	634.0175	987.0929 (98a)
Space heating requirement - total per year (kWh/year)												4533.3682
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	968.4863	760.7527	580.8014	268.5112	80.2598	0.0000	0.0000	0.0000	0.0000	253.4464	634.0175	987.0929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4533.3682
Space heating per m2										(98c) / (4) =		31.2776 (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 %)												288.5743 (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	968.4863	760.7527	580.8014	268.5112	80.2598	0.0000	0.0000	0.0000	0.0000	253.4464	634.0175	987.0929 (98)
Space heating efficiency (main heating system 1)	288.5743	288.5743	288.5743	288.5743	288.5743	0.0000	0.0000	0.0000	0.0000	288.5743	288.5743	288.5743 (210)
Space heating fuel (main heating system)	335.6108	263.6246	201.2658	93.0475	27.8125	0.0000	0.0000	0.0000	0.0000	87.8271	219.7069	342.0585 (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	290.1796	256.5792	272.3010	238.5558	230.7084	207.2848	204.0517	212.4321	215.0879	240.5817	256.7493	286.8818 (64)
Efficiency of water heater												112.5000 (216)
(217)m	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000 (217)
Fuel for water heating, kWh/month	257.9374	228.0704	242.0453	212.0496	205.0742	184.2532	181.3793	188.8285	191.1893	213.8504	228.2216	255.0060 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-68.1528	-93.8653	-138.5756	-161.6122	-168.2879	-159.2948	-156.1545	-147.2593	-128.8489	-110.0092	-77.0621	-57.9784 (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												1570.9538 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												112.5000
Water heating fuel used												2587.9051 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
Total electricity for the above, kWh/year												0.0000 (231)
Electricity for lighting (calculated in Appendix L)												263.3572 (232)

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Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-1467.1010	(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	2955.1151	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1570.9538	26.0600	409.3905 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2587.9051	26.0600	674.4081 (247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)
Energy for lighting	263.3572	26.0600	68.6309 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1467.1010	26.0600	-382.3265
PV Unit electricity exported	0.0000	5.8100	0.0000
Total			-382.3265 (252)
Total energy cost			770.1030 (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	1570.9538	0.1563	245.5310 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2587.9051	0.1410	364.7893 (264)
Space and water heating			610.3203 (265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1467.1010	0.1345	-197.3632
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-197.3632 (269)
Total CO2, kg/year			450.9677 (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	1570.9538	1.5786	2479.9643 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2587.9051	1.5212	3936.7716 (278)
Space and water heating			6416.7359 (279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (281)
Energy for lighting	263.3572	1.5338	403.9460 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1467.1010	1.4972	-2196.5206
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2196.5206 (283)
Total Primary energy kWh/year			4624.1613 (286)

SAP 10 EPC IMPROVEMENTS

Crescent Terrace

Current energy efficiency rating:	B 84
Current environmental impact rating:	A 97

N Solar water heating	Recommended
U Solar photovoltaic panels	Already installed
V2 Wind turbine	Not applicable
Recommended measures:	
N Solar water heating	SAP change + 2.4
	Cost change -£ 134
	CO2 change -65 kg (14.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£134	0.45 kg/m²	B 86
Total Savings	£134	0.45 kg/m²	A 97
Potential energy efficiency rating:			B 86
Potential environmental impact rating:			A 97

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 6.1 (11 Jun 2019)

Typical heating and lighting costs of this home (per year, Thames Valley):	Current	Potential	Saving
Electricity	£1152	£997	£155
Space heating	£409	£431	-£22
Water heating	£674	£498	£177

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Lighting	£69	£69	£0
Generated (PV)	-£382	-£361	-£21
Total cost of fuels	£770	£636	£134
Total cost of uses	£770	£637	£134
Delivered energy	20 kWh/m²	17 kWh/m²	4 kWh/m²
Carbon dioxide emissions	0.5 tonnes	0.4 tonnes	0.1 tonnes
CO2 emissions per m²	3 kg/m²	3 kg/m²	0 kg/m²
Primary energy	32 kWh/m²	27 kWh/m²	5 kWh/m²

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

1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Main dwelling	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)
Ground floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)
First floor			(4)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 365.1600 (5)
Dwelling volume			

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	3 * 10 =	30.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.0822 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3322	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3322 (21)
Wind speed	Jan 5.1000	Feb 5.0000
Wind factor	1.2750	1.2500
Adj infilt rate	0.4235	0.4152
Effective ac	0.5897	0.5862

3. Heat losses and heat loss parameter

Element	Gross m²	Openings m²	NetArea m²	U-value W/m²K	A x U W/K	K-value kJ/m²K	A x K kJ/K
Main dwelling							
Window			21.2300	1.1450	24.3092		(27)
Front Door			1.8900	1.2000	2.2680		(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000 (28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000 (28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000 (29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800 (30)
Total net area of external elements Aum(A, m²)			273.8000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		60.5413		(33)
Main dwelling							
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000 (32)
Ground Floor			59.5600			9.0000	536.0400 (32c)
1st Floor			173.9100			9.0000	1565.1900 (32c)
Internal Floor 1			58.4200			18.0000	1051.5600 (32d)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 31416.7700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K							216.7571 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				12.9700	0.0260	0.3372	
E3 Sill				7.5700	0.0230	0.1741	
E4 Jamb				33.6900	0.0180	0.6064	
E5 Ground floor (normal)				23.8196	0.0730	1.7388	
E6 Intermediate floor within a dwelling				10.7210	0.0010	0.0107	
E20 Exposed floor (normal)				5.3243	0.0470	0.2502	
E21 Exposed floor (inverted)				13.0920	0.3200	4.1895	
P1 Party wall - Ground floor				14.1428	0.0580	0.8203	
P2 Party wall - Intermediate floor within a dwelling				14.1428	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)				21.5927	0.0330	0.7126	
E10 Eaves (insulation at ceiling level)				16.0454	0.0550	0.8825	
E16 Corner (normal)				4.8000	0.0400	0.1920	
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0820	-0.3936	
E18 Party wall between dwellings				20.0000	0.0320	0.6400	

7.4499	0.4800	3.5759	
			13.7367 (36)
	(36a)	=	0.0000
(33)	+	(36)	+
	(36a)	=	74.2779 (37)

[illegible]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0027	0.9998	0.9970	0.9837	0.9812	0.9696	0.9696	0.9674	0.9740	0.9812	0.9862	0.9915 (40)
HLP (average)												0.9837
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

Assumed occupancy												2.9260 (42)
Hot water usage for mixer showers	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978 (42a)
Hot water usage for baths	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284 (42b)
Hot water usage for other uses	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947 (42c)
Average daily hot water use (litres/day)												137.4320 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210 (44)
Energy content (annual)	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874 (45)
Distribution loss (46)m = 0.15 x (45)m	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231 (46)
Water storage loss:												
Store volume												200.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9720 (55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	290.1796	256.5792	270.9052	231.8022	217.9141	194.6781	191.0248	200.3357	209.6850	239.1859	256.7493	286.8818 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.8000 (H2)
Collector linear heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0000 (H4)
Collector loop efficiency												0.9000 (H5)
Incidence angle modifier												1.0000 (H6)
Overshading factor												0.8000 (H8)
Overall heat loss coefficient of system												6.5000 (H10)
Heat loss coefficient of collector loop												3.9667 (H11)
Dedicated solar storage volume												75.0000 (H12)
Effective solar volume												75.0000 (H14)
Reference volume												225.0000 (H15)
Storage tank correction coefficient												1.3161 (H16)
Heat delivered to hot water												631.2995 (H24)
Heat delivered to space heating												0.0000 (H29)
Solar input												631.2995
Solar input	-0.0000	-16.1942	-58.8217	-81.2550	-106.6614	-98.3836	-97.6993	-85.1381	-58.4032	-28.7429	-0.0000	-0.0000 (63c)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817 (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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383 (71)
Water heating gains (Table 5)	163.2347	160.5042	153.7438	136.2133	122.8992	115.2687	110.7359	115.4817	126.8765	139.5681	152.1192	161.7609 (72)
Total internal gains	784.6093	782.5885	757.3518	707.1098	655.6138	614.5621	590.3237	594.3597	624.2308	669.6340	720.3669	763.4299 (73)

[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
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North	13.9200	10.6334	0.7200	0.7000	0.7700	51.6981 (74)
South	7.3100	46.7521	0.7200	0.7000	0.7700	119.3664 (78)

Solar gains	171.0645	294.2891	416.9028	551.1090	656.5442	671.1265	638.8412	555.8622	461.9802	328.4616	205.2661	146.2416 (83)
Total gains	955.6737	1076.8776	1174.2547	1258.2188	1312.1580	1285.6886	1229.1649	1150.2220	1086.2110	998.0956	925.6330	909.6715 (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	60.0465	60.2203	60.3917	61.2101	61.3656	62.1004	62.1004	62.2384	61.8153	61.3656	61.0517	60.7269
alpha	5.0031	5.0147	5.0261	5.0807	5.0910	5.1400	5.1400	5.1492	5.1210	5.0910	5.0701	5.0485
util living area	0.9943	0.9887	0.9753	0.9362	0.8391	0.6618	0.4956	0.5479	0.7879	0.9517	0.9888	0.9955 (86)
Living	19.7416	19.9187	20.1896	20.5319	20.8104	20.9584	20.9922	20.9873	20.8986	20.5471	20.0838	19.7115
Non living	18.6107	18.8375	19.1814	19.6116	19.9317	20.0826	20.1058	20.1053	20.0313	19.6388	19.0573	18.5790
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000 (87)
Th 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (88)
util rest of house	0.9927	0.9856	0.9682	0.9174	0.7942	0.5836	0.3989	0.4481	0.7188	0.9335	0.9851	0.9942 (89)
MIT 2	20.0811	20.0835	20.0858	20.0970	20.0991	20.1088	20.1088	20.1106	20.1050	20.0991	20.0948	20.0904 (90)
Living area fraction									FLA = Living area / (4) =			0.1205 (91)
MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000 (92)
Temperature adjustment												0.0000
adjusted MIT	20.1918	20.1939	20.1960	20.2057	20.2076	20.2161	20.2161	20.2177	20.2128	20.2076	20.2039	20.2000 (93)

8. Space heating requirement

Utilisation	0.9929	0.9860	0.9692	0.9199	0.8001	0.5935	0.4108	0.4605	0.7280	0.9361	0.9856	0.9944 (94)
Useful gains	948.8630	1061.8470	1138.0604	1157.4512	1049.9051	763.1136	504.9748	529.6841	790.7104	934.2952	912.3153	904.5582 (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	2309.6366	2216.3261	1979.1289	1611.8909	1209.8738	789.2275	508.1703	535.3093	862.9905	1366.3062	1873.0996	2299.3101 (97)
Space heating kWh	1012.4156	775.8100	625.7550	327.1966	119.0168	0.0000	0.0000	0.0000	0.0000	321.4162	691.7647	1037.6954 (98a)
Space heating requirement - total per year (kWh/year)												4911.0703
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	1012.4156	775.8100	625.7550	327.1966	119.0168	0.0000	0.0000	0.0000	0.0000	321.4162	691.7647	1037.6954 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4911.0703
Space heating per m2										(98c) / (4) =		33.8835 (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 %)												288.6310 (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	1012.4156	775.8100	625.7550	327.1966	119.0168	0.0000	0.0000	0.0000	0.0000	321.4162	691.7647	1037.6954 (98)
Space heating efficiency (main heating system 1)	288.6310	288.6310	288.6310	288.6310	288.6310	0.0000	0.0000	0.0000	0.0000	288.6310	288.6310	288.6310 (210)
Space heating fuel (main heating system)	350.7647	268.7896	216.8011	113.3616	41.2349	0.0000	0.0000	0.0000	0.0000	111.3589	239.6710	359.5232 (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	290.1796	240.3850	212.0835	150.5472	111.2527	96.2944	93.3254	115.1975	151.2818	210.4431	256.7493	286.8818 (64)
Efficiency of water heater (217)m	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000 (216)
Fuel for water heating, kWh/month	257.9374	213.6755	188.5187	133.8198	98.8913	85.5951	82.9559	102.3978	134.4727	187.0605	228.2216	255.0060 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-61.8153	-91.4829	-134.9387	-150.0910	-153.9448	-137.7508	-135.5817	-129.8193	-117.4393	-103.0185	-68.9864	-52.9624 (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												

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Space heating fuel - main system 1	1701.5050	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	112.5000	
Water heating fuel used	1968.5524	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	80.0000	(231)
Electricity for lighting (calculated in Appendix L)	263.3572	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1337.8311	(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	2675.5834	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1701.5050	16.4900	280.5782	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1968.5524	16.4900	324.6143	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	263.3572	16.4900	43.4276	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1337.8311	16.4900	-220.6083	
PV Unit electricity exported	0.0000	5.5900	0.0000	
Total			-220.6083	(252)
Total energy cost			441.2037	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8362	(257)
SAP value		86.4447	
SAP rating (Section 12)		86	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1701.5050	0.1557	264.9427	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1968.5524	0.1453	286.0865	(264)
Space and water heating			551.0292	(265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970	(267)
Energy for lighting	263.3572	0.1443	38.0106	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1337.8311	0.1350	-180.6499	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-180.6499	(269)
Total CO2, kg/year			419.4869	(272)
CO2 emissions per m2			2.8900	(273)
EI value			97.0406	
EI rating			97	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Main dwelling				
Ground floor	58.4200 (1b)	x 2.4000 (2b)	= 140.2080 (1b) - (3b)	
First floor	86.5200 (1c)	x 2.6000 (2c)	= 224.9520 (1c) - (3c)	
Total floor area IFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	144.9400		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	365.1600 (5)	

2. Ventilation rate

m3 per hour

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.0822 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3322	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3322	(21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.9000	4.7000	4.6000	4.1000	4.0000	3.6000	3.7000	3.7000	3.9000	4.2000	4.2000	4.5000	(22)
Adj infilt rate	1.2250	1.1750	1.1500	1.0250	1.0000	0.9000	0.9250	0.9250	0.9750	1.0500	1.0500	1.1250	(22a)
Effective ac	0.4069	0.3903	0.3820	0.3405	0.3322	0.2989	0.3072	0.3072	0.3239	0.3488	0.3488	0.3737	(22b)
	0.5828	0.5762	0.5730	0.5580	0.5552	0.5447	0.5472	0.5472	0.5524	0.5608	0.5608	0.5698	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Main dwelling								
Window			21.2300	1.1450	24.3092			(27)
Front Door			1.8900	1.2000	2.2680			(26)
Heatloss Floor 1			58.4200	0.1200	7.0104	110.0000	6426.2000	(28a)
Heatloss Floor 2			28.0900	0.1200	3.3708	0.0000	0.0000	(28b)
External Wall 1	100.7700	23.1200	77.6500	0.1700	13.2005	190.0000	14753.5000	(29a)
External Roof 1	86.5200		86.5200	0.1200	10.3824	9.0000	778.6800	(30)
Total net area of external elements Aum(A, m2)			273.8000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5413			(33)
Main dwelling								
Party Wall 1			90.0800	0.0000	0.0000	70.0000	6305.6000	(32)
Ground Floor			59.5600			9.0000	536.0400	(32c)
1st Floor			173.9100			9.0000	1565.1900	(32c)
Internal Floor 1			58.4200			18.0000	1051.5600	(32d)
Heat capacity Cm = Sum(A x k)								
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								(34)
List of Thermal Bridges								(35)
K1 Element				Length	Psi-value		Total	
E2 Other lintels (including other steel lintels)				12.9700	0.0260		0.3372	
E3 Sill				7.5700	0.0230		0.1741	
E4 Jamb				33.6900	0.0180		0.6064	
E5 Ground floor (normal)				23.8198	0.0730		1.7388	
E6 Intermediate floor within a dwelling				10.7210	0.0010		0.0107	
E20 Exposed floor (normal)				5.3243	0.0470		0.2502	
E21 Exposed floor (inverted)				13.0920	0.3200		4.1895	
P1 Party wall - Ground floor				14.1428	0.0580		0.8203	
P2 Party wall - Intermediate floor within a dwelling				14.1428	0.0000		0.0000	
P4 Party wall - Roof (insulation at ceiling level)				21.5927	0.0330		0.7126	
E10 Eaves (insulation at ceiling level)				16.0454	0.0550		0.8825	
E16 Corner (normal)				4.8000	0.0400		0.1920	
E17 Corner (inverted - internal area greater than external area)				4.8000	-0.0820		-0.3936	
E18 Party wall between dwellings				20.0000	0.0320		0.6400	
P7 Party Wall - Exposed floor (normal)				7.4499	0.4800		3.5759	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7367	(36)
Point Thermal bridges							0.0000	(36a)
Total fabric heat loss							74.2779	(33) + (36) + (36a) = (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	70.2266	69.4289	69.0426	67.2353	66.8988	65.6358	65.9391	65.9391	66.5706	67.5801	67.5801	68.6645	(38)
Average = Sum(39)m / 12 =	144.5046	143.7069	143.3205	141.5132	141.1767	139.9137	140.2170	140.2170	140.8485	141.8581	141.8581	142.9424	(39)
												141.8397	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.9970	0.9915	0.9888	0.9764	0.9740	0.9653	0.9674	0.9674	0.9718	0.9787	0.9787	0.9862	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.9260 (42)
Hot water usage for mixer showers													
Hot water usage for baths	73.2785	72.1773	70.5726	67.5023	65.2364	62.7096	61.2734	62.8659	64.6117	67.3247	70.4610	72.9978	(42a)
Hot water usage for other uses	31.6354	31.1656	30.5039	29.2840	28.3706	27.3577	26.8106	27.4676	28.1829	29.2667	30.5118	31.5284	(42b)
Average daily hot water use (litres/day)	44.5947	42.9731	41.3515	39.7299	38.1082	36.4866	36.4866	38.1082	39.7299	41.3515	42.9731	44.5947	(42c)
												137.4320	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	149.5087	146.3160	142.4280	136.5162	131.7152	126.5539	124.5706	128.4418	132.5245	137.9430	143.9459	149.1210	(44)
Energy content (annual)	236.7852	208.3520	218.9066	186.8838	177.3140	155.6128	150.6573	159.0377	163.4159	187.1873	205.0773	233.4874	(45)
Distribution loss (46)m = 0.15 x (45)m													
Water storage loss:	35.5178	31.2528	32.8360	28.0326	26.5971	23.3419	22.5986	23.8557	24.5124	28.0781	30.7616	35.0231	(46)
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8000	(48)
Temperature factor from Table 2b												0.5400	(49)

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Enter (49) or (54) in (55)													0.9720 (55)
Total storage loss	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(56)
If cylinder contains dedicated solar storage	30.1320	27.2160	30.1320	29.1600	30.1320	29.1600	30.1320	30.1320	29.1600	30.1320	29.1600	30.1320	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	290.1796	256.5792	270.9052	231.8022	217.9141	194.6781	191.0248	200.3357	209.6850	239.1859	256.7493	286.8818	(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)
FV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector linear heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H4)
Collector loop efficiency													(H5)
Incidence angle modifier													(H6)
Overshading factor													(H8)
Overall heat loss coefficient of system													(H10)
Heat loss coefficient of collector loop													(H11)
Dedicated solar storage volume													(H12)
Effective solar volume													(H14)
Reference volume													(H15)
Storage tank correction coefficient													(H16)
Heat delivered to hot water													(H24)
Heat delivered to space heating													(H29)
Solar input													(63c)
FGHRS													(63d)
Output from w/h	290.1796	238.6084	209.5641	142.2541	107.2907	86.4630	84.5130	105.1987	142.4312	202.5382	253.0792	286.8818	(64)
								Total per year (kWh/year) =	Sum(64)m =			2149.0018	(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	121.4466	107.8588	114.3854	98.0736	91.4370	82.9935	82.3875	85.9184	91.3511	103.8387	109.5258	120.3501	(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	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	175.5575	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	37.2809	33.1126	26.9290	20.3870	15.2395	12.8658	13.9020	18.0703	24.2539	30.7959	35.9434	38.3171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	470.0928	474.9709	462.6783	436.5087	403.4743	372.4267	351.6849	346.8068	359.0995	385.2690	418.3034	449.3511	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	55.4817	(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)	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	-117.0383	(71)
Water heating gains (Table 5)	163.2347	160.5042	153.7438	136.2133	122.8992	115.2687	110.7359	115.4817	126.8765	139.5681	152.1192	161.7609	(72)
Total internal gains	784.6093	782.5885	757.3518	707.1098	655.6138	614.5621	590.3237	594.3597	624.2308	669.6340	720.3669	763.4299	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					13.9200	12.0246	0.7200	0.7000			0.7700			58.4622 (74)
South					7.3100	51.4430	0.7200	0.7000			0.7700			131.3432 (78)
Solar gains	189.8054	299.6057	422.2821	589.1663	675.0350	727.9198	685.2635	601.4045	498.3736	356.0936	233.4191	160.6498	(83)	
Total gains	974.4147	1082.1943	1179.6339	1296.2762	1330.6488	1342.4819	1275.5872	1195.7642	1122.6044	1025.7276	953.7860	924.0796	(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	60.3917	60.7269	60.8907	61.6683	61.8153	62.3733	62.2384	62.2384	61.9593	61.5184	61.5184	61.0517	
alpha	5.0261	5.0485	5.0594	5.1112	5.1210	5.1582	5.1492	5.1492	5.1306	5.1012	5.1012	5.0701	
util living area	0.9934	0.9884	0.9724	0.9199	0.8014	0.5769	0.3830	0.4193	0.7088	0.9341	0.9859	0.9947	(86)
Living	19.7918	19.9376	20.2411	20.6031	20.8612	20.9803	20.9981	20.9970	20.9456	20.6300	20.1532	19.7694	
Non living	18.6781	18.8666	19.2511	19.7006	19.9892	20.1017	20.1101	20.1098	20.0729	19.7388	19.1497	18.6562	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	31	28	31	30	31	30	31	31	30	31	30	31	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948	(88)
util rest of house	0.9915	0.9852	0.9644	0.8970	0.7490	0.4943	0.2866	0.3173	0.6258	0.9095	0.9813	0.9932	(89)
MIT 2	20.0858	20.0904	20.0927	20.1031	20.1050	20.1123	20.1106	20.1106	20.1069	20.1011	20.1011	20.0948	(90)
Living area fraction													(91)
MIT	20.1960	20.2000	20.2020	20.2111	20.2128	20.2193	20.2177	20.2177	20.2145	20.2094	20.2094	20.2039	(92)
Temperature adjustment													(93)
adjusted MIT	20.1960	20.2000	20.2020	20.2111	20.2128	20.2193	20.2177	20.2177	20.2145	20.2094	20.2094	20.2039	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Utilisation	0.9918	0.9856	0.9654	0.9000	0.7558	0.5046	0.2983	0.3297	0.6365	0.9130	0.9819	0.9934 (94)
Useful gains	966.4092	1066.6428	1138.8769	1166.7106	1005.7412	677.4064	380.5393	394.2082	714.5242	936.4473	936.5337	918.0122 (95)
Ext temp.	4.5000	4.9000	6.8000	9.3000	12.3000	15.3000	17.5000	17.4000	14.9000	11.2000	7.4000	4.5000 (96)
Heat loss rate W	2268.1381	2198.7152	1920.7753	1544.0692	1117.1086	688.2725	381.0705	395.0922	748.5404	1278.0528	1817.1136	2244.7500 (97)
Space heating kWh	968.4863	760.7527	581.7324	271.6982	82.8573	0.0000	0.0000	0.0000	0.0000	254.1545	634.0175	987.0929 (98a)
Space heating requirement - total per year (kWh/year)												4540.7918
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	968.4863	760.7527	581.7324	271.6982	82.8573	0.0000	0.0000	0.0000	0.0000	254.1545	634.0175	987.0929 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4540.7918
Space heating per m2												31.3288 (99)
(98c) / (4) =												

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 %)												288.5743 (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	968.4863	760.7527	581.7324	271.6982	82.8573	0.0000	0.0000	0.0000	0.0000	254.1545	634.0175	987.0929 (98)
Space heating efficiency (main heating system 1)	288.5743	288.5743	288.5743	288.5743	288.5743	0.0000	0.0000	0.0000	0.0000	288.5743	288.5743	288.5743 (210)
Space heating fuel (main heating system)	335.6108	263.6246	201.5885	94.1519	28.7126	0.0000	0.0000	0.0000	0.0000	88.0725	219.7069	342.0585 (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	290.1796	238.6084	209.5641	142.2541	107.2907	86.4630	84.5130	105.1987	142.4312	202.5382	253.0792	286.8818 (64)
Efficiency of water heater	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000	112.5000 (216)
Fuel for water heating, kWh/month	257.9374	212.0964	186.2792	126.4481	95.3695	76.8560	75.1226	93.5099	126.6055	180.0339	224.9593	255.0060 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	6.7945	6.1370	6.7945	6.5753	6.7945	6.5753	6.7945	6.7945	6.5753	6.7945	6.5753	6.7945 (231)
Lighting	32.6318	26.1784	23.5708	17.2690	13.3390	10.8981	12.1683	15.8168	20.5445	26.9555	30.4462	33.5387 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-68.2251	-93.6372	-136.2351	-153.9140	-153.5288	-141.1601	-138.4047	-133.7603	-122.3856	-108.6482	-77.1236	-58.0351 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	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)	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)	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)	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)	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)	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)	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												1573.5263 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												112.5000
Water heating fuel used												1910.2238 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
pump for solar water heating												80.0000 (230g)
Total electricity for the above, kWh/year												80.0000 (231)
Electricity for lighting (calculated in Appendix L)												263.3572 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-1385.0577 (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												2442.0495 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1573.5263	26.0600	410.0609 (240)	
Total CO2 associated with community systems			0.0000 (473)	
Water heating (other fuel)	1910.2238	26.0600	497.8043 (247)	
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000 (247a)	
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	80.0000	26.0600	20.8480 (249)	
Energy for lighting	263.3572	26.0600	68.6309 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1385.0577	26.0600	-360.9460	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-360.9460 (252)	
Total energy cost			636.3981 (255)	

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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	1573.5263	0.1563	245.8905 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1910.2238	0.1459	278.6505 (264)
Space and water heating			524.5410 (265)
Pumps, fans and electric keep-hot	80.0000	0.1387	11.0970 (267)
Energy for lighting	263.3572	0.1443	38.0106 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1385.0577	0.1352	-187.3180
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-187.3180 (269)
Total CO2, kg/year			386.3306 (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	1573.5263	1.5785	2483.8675 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1910.2238	1.5396	2940.9915 (278)
Space and water heating			5424.8590 (279)
Pumps, fans and electric keep-hot	80.0000	1.5128	121.0240 (281)
Energy for lighting	263.3572	1.5338	403.9460 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1385.0577	1.4999	-2077.4191
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-2077.4191 (283)
Total Primary energy kWh/year			3872.4099 (286)

Appendix B – BRUKL Documents

Project name

Club House - Be Green

As designed

Date: Tue Jun 18 14:21:01 2024

Administrative information

Building Details

Address: TBC

Certifier details

Name: Name

Telephone number: Phone

Address: Street Address, City, Postcode

Certification tool

Calculation engine: Apache

Calculation engine version: 7.0.24

Interface to calculation engine: IES Virtual Environment

Interface to calculation engine version: 7.0.24

BRUKL compliance module version: v6.1.e.1

Foundation area [m²]: 316.38The CO₂ emission and primary energy rates of the building must not exceed the targets

Target CO ₂ emission rate (TER), kgCO ₂ /m ² annum	4.03
Building CO ₂ emission rate (BER), kgCO ₂ /m ² annum	2.3
Target primary energy rate (TPER), kWh _{PE} /m ² annum	42.82
Building primary energy rate (BPER), kWh _{PE} /m ² annum	22.21
Do the building's emission and primary energy rates exceed the targets?	BER ≤ TER BPER ≤ TPER

The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Fabric element	U _{a-Limit}	U _{a-Calc}	U _{i-Calc}	First surface with maximum value
Walls*	0.26	0.18	0.18	0000001F:Surf[8]
Floors	0.18	0.12	0.12	0000001F:Surf[0]
Pitched roofs	0.16	-	-	No pitched roofs in building
Flat roofs	0.18	0.12	0.12	0000001F:Surf[1]
Windows** and roof windows	1.6	1.6	1.6	0000001F:Surf[2]
Rooflights***	2.2	-	-	No roof lights in building
Personnel doors^	1.6	1.6	1.6	00000020:Surf[6]
Vehicle access & similar large doors	1.3	-	-	No vehicle access doors in building
High usage entrance doors	3	-	-	No high usage entrance doors in building

U_{a-Limit} = Limiting area-weighted average U-values [W/(m²K)]U_{i-Calc} = Calculated maximum individual element U-values [W/(m²K)]U_{a-Calc} = Calculated area-weighted average U-values [W/(m²K)]

* Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.

** Display windows and similar glazing are excluded from the U-value check. *** Values for rooflights refer to the horizontal position.

^ For fire doors, limiting U-value is 1.8 W/m²K

NB: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air permeability	Limiting standard	This building
m ³ /(h.m ²) at 50 Pa	8	3

Building services

For details on the standard values listed below, system-specific guidance, and additional regulatory requirements, refer to the Approved Documents.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- 001 | ASHP CHAV-R450YA-HPB

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	3.24	-	0	-	0.85
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES
* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps.					

2- 002 | Direct Electric

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	1	-	0	-	0.85
Standard value	N/A	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

"No HWS in project, or hot water is provided by HVAC system"

Zone-level mechanical ventilation, exhaust, and terminal units

ID	System type in the Approved Documents
A	Local supply or extract ventilation units
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal balanced supply and extract ventilation system
E	Local balanced supply and extract ventilation units
F	Other local ventilation units
G	Fan assisted terminal variable air volume units
H	Fan coil units
I	Kitchen extract with the fan remote from the zone and a grease filter
NB: Limiting SFP may be increased by the amounts specified in the Approved Documents if the installation includes particular components.	

Zone name	SFP [W/(l/s)]										HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1			
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Bathroom	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Bathroom	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Club Room	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	-	N/A

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I	Zone	Standard
Standard value	0.3	1.1	0.5	2.3	2	0.5	0.5	0.4	1		
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - Changing Room/Showers	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - Bar	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - Kitchen	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - Office	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A
00 - WC	-	-	-	0.8	-	-	-	-	-	-	N/A

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
Standard value		95	80	0.3
00 - Changing Room/Showers		100	-	-
00 - Changing Room/Showers		100	-	-
00 - Changing Room/Showers		100	-	-
00 - Changing Room/Showers		100	-	-
00 - Bathroom		100	-	-
00 - Bathroom		100	-	-
00 - CAC 1		100	-	-
00 - Club Room		100	-	-
00 - CAC 2		100	-	-
00 - Changing Room/Showers		100	-	-
00 - Changing Room/Showers		100	-	-
00 - WC		100	-	-
00 - WC		100	-	-
00 - Changing Room/Showers		100	-	-
00 - WC		100	-	-
00 - WC		100	-	-
00 - Changing Room/Showers		100	-	-
00 - Store		100	-	-
00 - Store		100	-	-
00 - Store		100	-	-
00 - Bar		100	-	-
00 - Clean cupboard		100	-	-
00 - Kitchen		100	-	-
00 - WC		100	-	-
00 - Office		100	-	-
00 - Lobby		100	-	-
00 - Plant		100	-	-
00 - WC		100	-	-

General lighting and display lighting		General luminaire	Display light source	
Zone name		Efficacy [lm/W]	Efficacy [lm/W]	Power density [W/m ²]
	Standard value	95	80	0.3
00 - Lobby		100	-	-
00 - Cellar		100	-	-
00 - WC		100	-	-
00 - WC		100	-	-

The spaces in the building should have appropriate passive control measures to limit solar gains in summer

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00 - Club Room	NO (-36.6%)	NO
00 - Bar	N/A	N/A
00 - Office	NO (-85.5%)	NO

Regulation 25A: Consideration of high efficiency alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	YES
Is evidence of such assessment available as a separate submission?	YES
Are any such measures included in the proposed design?	YES

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Floor area [m ²]	431.3	431.3
External area [m ²]	1207	1181.7
Weather	LON	LON
Infiltration [m ³ /hm ² @ 50Pa]	3	3
Average conductance [W/K]	230.3	0
Average U-value [W/m ² K]	0.19	0
Alpha value* [%]	24.73	10

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area Building Type

Retail/Financial and Professional Services
 Restaurants and Cafes/Drinking Establishments/Takeaways
 Offices and Workshop Businesses
 General Industrial and Special Industrial Groups
 Storage or Distribution
 Hotels
 Residential Institutions: Hospitals and Care Homes
 Residential Institutions: Residential Schools
 Residential Institutions: Universities and Colleges
 Secure Residential Institutions
 Residential Spaces
 Non-residential Institutions: Community/Day Centre
 Non-residential Institutions: Libraries, Museums, and Galleries

100

Non-residential Institutions: Education

Non-residential Institutions: Primary Health Care Building
 Non-residential Institutions: Crown and County Courts
 General Assembly and Leisure, Night Clubs, and Theatres
 Others: Passenger Terminals
 Others: Emergency Services
 Others: Miscellaneous 24hr Activities
 Others: Car Parks 24 hrs
 Others: Stand Alone Utility Block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	11.24	10.42
Cooling	0	0
Auxiliary	5.36	3.96
Lighting	6.21	6.23
Hot water	9.7	8.06
Equipment*	32.09	32.09
TOTAL **	32.5	28.67

* Energy used by equipment does not count towards the total for consumption or calculating emissions.

** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	18.85	0.02
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0
<i>Displaced electricity</i>	<i>18.85</i>	<i>0.02</i>

Energy & CO₂ Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m ²]	122.75	104.04
Primary energy [kWh _{PE} /m ²]	22.21	42.82
Total emissions [kg/m ²]	2.3	4.03

HVAC Systems Performance										
System Type	Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEFF	Cool SSEER	Heat gen SEFF	Cool gen SEER	
[ST] Central heating using water: floor heating, [HS] ASHP, [HFT] Electricity, [CFT] Electricity										
Actual	180.9	0	16.5	0	5.2	3.04	0	3.24	0	
Notional	153.1	0	15.3	0	2.5	2.78	0	----	----	
[ST] Other local room heater - unfanned, [HS] Direct or storage electric heater, [HFT] Electricity, [CFT] Electricity										
Actual	2.1	0	0.7	0	4.5	0.8	0	1	0	
Notional	4.4	0	0.9	0	1.8	1.41	0	----	----	
[ST] No Heating or Cooling										
Actual	0	0	0	0	0	0	0	0	0	
Notional	0	0	0	0	0	0	0	----	----	

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type



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