



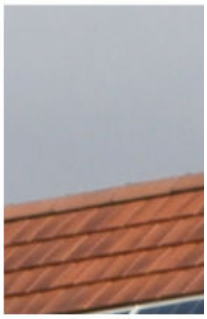

environmental economics

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Energy Statement

White Post Road, Bodicote, Oxfordshire

Client: BDW Mercia

Author: Ruth Ferguson


Revision History

Version	Date Issued	Issued by	QA Check
1	17/07/2019	[redacted] *William Vincent*	[redacted] *Michael Woodbridge*
2	28/02/2022	[redacted] *Matt Pirrie*	[redacted] *William Vincent*
3	22/03/2024	[redacted] *Ruth Ferguson*	[redacted] *Tim James*

About Environmental Economics

Our team of experienced consultants specialise in construction and building energy. We have qualifications in sustainability, energy, engineering, building physics and construction as well as environmental, quality management and auditing.

Over the last decade, we have provided assessments and consultancy for some of the largest UK house builders, including Barratt Developments, David Wilson Homes, Bellway Homes, Abbey New Homes and Davidsons. We develop flexible, practical, cost-effective specifications for our clients through identifying solutions and delivering design advice. This includes the following disciplines:

- *Energy Reports*
- *Compliance assessments and advice covering*
  - *Part L (SAP)*
  - *Part F (ventilation)*
  - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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Contents

1. Executive Summary

1.1.1. Environmental Economics Ltd has been commissioned by BDW Mercia to prepare an energy report for the residential site White Post Road, Bodicote, Oxfordshire. This document sets out how the development proposal meets the condition set out by the North Oxfordshire District Council

1.1.2. The proposed development is designed to achieve low carbon emissions and energy reduction through the adoption of good fabric performance and employment of low and zero carbon technologies.

1.1.3. This energy statement demonstrates how the proposed development meets the carbon reduction requirements in Condition 12 from Planning Permission 21/03639/F, by achieving a reduction in Carbon emissions of at least 19% over Part L 2013.

1.1.4. The following LZCT will be adopted on the 80 plots being built to Part L 2021:

- Photovoltaic panels (excluding the maisonettes)
- Waste Water Heat Recovery (WWHR)
- Decentralised Mechanical Extract Ventilation (dMEV)
- Flue Gas Heat Recovery (FGHR)

1.1.5. Potential overheating risk will be assessed for the plots being built to Part L 2021 in accordance with Approved Document O.

1.1.6. The use of smart meters will provide occupiers with real time data which will allow occupiers to manage their energy consumption, save money and reduce Carbon. This is particularly important as the UK migrates towards half-hourly pricing levels and the proposed smart grid system.

1.1.7. While the development is still at an early stage of the design process, it is considered that the proposal meets the planning condition and represents an energy-efficient development.

2. Project Overview

2.1. Description of Site

2.1.1. The site proposal consists of the construction of 107 residential dwellings which include detached, semi-detached and terraced houses.

2.1.2. The proposed site plans are shown in Appendix A.

2.2. Client Brief

2.2.1. The planning authority for this site is the North Oxfordshire District Council.

2.2.2. This energy statement demonstrates how the proposed development meets the Carbon reduction requirements in Condition 12 from planning permission 21/03639/F, which states:
"Prior to the commencement of any development hereby approved, an Energy Statement shall be submitted to and approved in writing by the Local Planning Authority, demonstrating how each dwelling hereby approved, will achieve a 19% reduction in carbon emissions above 2013 Building regulations and a water efficiency of not more than 110 litres/person/day."

2.2.3. This report should be read in conjunction with other reports prepared for this development.

2.3. Building regulations

2.3.1. The majority of the proposed dwellings in this development (80 plots) are being built to Part L 2021. The remaining 27 plots have been built to Part L 2013.

2.3.2. A sample of the proposed dwellings have been modelled using the SAP 2012 methodology for the Part L1A 2013 plots, and using the SAP 10 methodology for the Part L1A 2021 plots.

2.3.3. These SAP reports can be found in Appendix C.

2.3.4. The specification improvements mentioned in this report help these plots in achieving Part L1A 2013 and Part L1A 2021 building regulation compliance as well as meeting the overall planning condition.

3. Design Response

3.1. Assessment Methodology

3.1.1. Environmental Economics have modelled a sample of the 107 proposed dwellings using both the Design SAP 2012 software and the Design SAP 10 software, both of which are licensed by Elmhurst and approved by BRE. This provides a number of outputs, and based on the provided specification for this proposed development, we were able to assess the following areas for our calculations:

- *Building regulations compliance, including:*
  - *Carbon emissions (kg CO2/m2/year)*
  - *Primary Energy Demand (kWh/m2/annum)*
  - *Fabric Energy Efficiency (kWh/m2/annum)*
- *Energy usage per year (kWh/annum)*
- *Energy costs per year (£/annum)*
- *More detailed breakdowns by end use (space heating, water heating, cooking, lighting, appliances)*

3.1.2. Each of these outputs can be used in different ways to analyse the performance of the dwelling. The total regulated carbon emissions for each property is based upon:

- *Space heating*
- *Water heating*
- *Electricity for pumps and fans*
- *Electricity for lighting*

3.1.3. SAP software is issued by independent software suppliers and checked and approved on behalf of government by the Building Research Establishment (BRE). As of 22nd November 2022.

3.1.4. The SAP worksheets used in the energy report calculations are shown in Appendix C.

3.2. Design Philosophy

3.2.1. Upgrades have been made to a number of elements from a standard build specification in order to improve energy efficiency across the development. The site adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Communities and Local Government Department. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in figure 1 below.

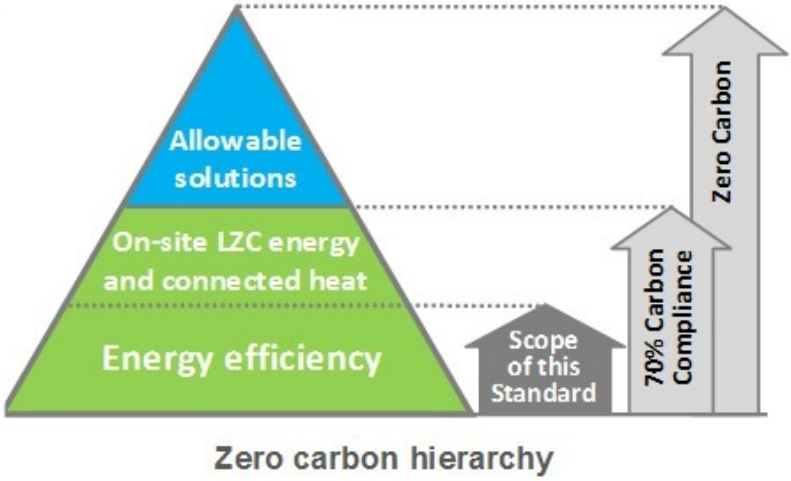


Figure 1

3.2.2. In order to reduce the residual carbon emissions, a number of improvements were made to the standard material and product specification. These improvements include:

- *Upgraded heating and hot water controls*
- *Improved insulation levels*
- *Design air permeability of 5.01m3/hr/m2 for the 2013 plots and 4.00m3/hr/m2 for the 2021 plots*
- *Bespoke low heat loss thermal bridging details*

3.3. Fabric Improvements Part L1A 2013

3.3.1. The building fabric for all Part L 2013 plots was improved from basic compliance with Part L1A 2013 to an enhanced specification. These fabric improvements reduce the space heating requirement upon a property. The improvements have been made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used. Changes to the U-Value of external elements are shown in table 1 below.

Table 1 – Part L 2013 Build Specification

Element	***Minimum Standard***	***Improved Specification***	
-	***W/m²k***	***Description***	***W/m²k***
Walls	0.30	50mm Alreflex Platinum Cavity	0.27
Roof	0.20	400mm Mineral Wool Horizontal Ceiling, Loft Space	0.11
		Flat Roof	0.17
Floors	0.25	150mm TE Platinum Insulation	0.13 - 0.15
Doors	2.00	Double glazed Low-E, u-PVC frame	1.00 – 1.70
Glazing	2.00	Double glazed Low-E, u-PVC frame	1.30

3.3.2. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability becomes increasingly significant in the overall fabric performance. Bespoke thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with standard practice.

3.3.3. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 5.01m3/hr.m2 has been set for all Part L 2013 houses on site, which is a 50% improvement on the maximum allowable rating in the 2013 Building Regulations.

3.4. Fabric Improvements Part L1A 2021

3.4.1. The building fabric for all Part L 2021 plots within the proposed development have been improved in relation to the ADL 2021 backstop notional specification. These fabric improvements reduce the space heating requirement upon a property. The improvements will be made through a combination of upgraded materials and increased insulation thicknesses. Enhanced glazing with a larger transmittance factor allowing for increased solar gains will also be used.

3.4.2. Proposed fabric designs and U-Values can be found in Table 2 below.

Table 2 – Part L 2021 Build Specification

Element	***Minimum Standard***	***Improved Specification***	
-	***W/m²k***	***Description***	***W/m²k***
Walls	0.26	Full-fill blown bead insulation in 100mm cavity	0.23
Roof	0.16	Loft Space – 500mm Mineral Wool	0.09
		Sloping Ceiling to have 100mm PUR between joists, and 55mm PUR Board underlaid	0.16
Floors	0.18	Cube 6 floor system	0.11
Doors	1.60	Double glazed Low-E, u-PVC frame	1.20
Glazing	1.60	Double glazed Low-E, u-PVC frame	1.30

3.4.3. As improvements are made to the thermal conductivity of main elements, thermal bridging and air permeability becomes increasingly significant in the overall fabric performance. Bespoke thermal bridging designs have been utilised, which achieve much lower heat loss levels in comparison with standard practice.

3.4.4. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 4.00m3/hr.m2 has been set for all houses on site which is an improvement on the maximum allowable rating in the 2021 Building Regulations.

3.5. Building Services Part L1A 2013

3.5.1. The systems used in a property to supply hot water and heating, as well as to control it, are important to the overall energy demand of a property. The 2013 Building Regulations state that all systems and their controls must adhere to the minimum standards shown in Domestic Heating Compliance Guide.

3.5.2. For a mains gas fired system the minimum boiler efficiency required is 86%. High efficiency condensing boilers have been specified throughout the site for both combination and cylinder-based systems. These boilers achieve a SAP 2012 rated efficiency of at least 89.4% and are recommended by the Energy Saving Trust.

3.5.3. Where installed, hot water cylinders can lose a significant amount of energy. In order to minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used.

3.5.4. Lighting provision will be from low energy fittings achieving a minimum efficacy of 45 lamp lumens per circuit watt.

3.6. Building Services & Renewable Energy (LZCT) Part L1A 2021

3.6.1. The systems used in a property to supply hot water and heating, as well as to control it, are important to the overall energy demand of a property.

3.6.2. The design of building services which provide space heating and domestic hot water, ventilation, and lighting, must be considered in a holistic way in order to avoid unintended consequences and to maximise the benefits from such systems.

3.6.3. After due consideration of the potential LZCT available (shown in Appendix B) the design team propose to adopt the following technologies which provide benefits / compliance with national and local policies as listed:

- ***Photovoltaic (PV) panels***
  - Low noise and visual pollution;
  - Efficient low-carbon source of renewable energy.
- ***Decentralised Mechanical Extract Ventilation (dMEV)***
  - Quieter than standard extractor fans;
  - Technology that manages humidity that is significantly more energy efficient in comparison to standard extractor fans.
- ***Waste Water Heat Recovery (WWHR)***
  - Passive technology, no maintenance required;
  - Recovers waste heat from shower, pre-heats incoming cold. This reduces the amount of hot water required from the hot water cylinder;
  - Typical systems recover ~60% waste heat.
- ***Flue Gas Heat Recovery (FGHR)***
  - Recovers waste heat from the flue of a boiler;
  - Reduces energy demand by reducing the temperature increase required for the boiler to operate.

3.6.4. PV will be installed on all Part L 2021 plots along with WWHR/FGHR/dMEV.

3.6.5. For a mains gas fired system, the minimum boiler efficiency required is 92%. Compliant Ideal Logic boilers have been adopted which exceed this requirement.

3.6.6. Where installed, hot water cylinders can lose a significant amount of energy. To minimise this energy loss and corresponding carbon emissions, cylinders which have higher levels of insulation in comparison to typical hot water cylinders will be used. Hot water distribution pipework will be fully insulated.

3.6.7. The viability of a heat network was considered for this development, however DHNs (District Heating Networks) are generally suited to development with high thermal demand, typically provided by sufficient density or a large anchor load, i.e., high-density flats or leisure centres.

3.6.8. The development of highly-insulated, high-efficiency homes such as those proposed limits the heating demand of the site, and therefore, the feasibility and viability of the installation of district heating. For these reasons, DHN is considered unsuitable for this development.

3.6.9. Lighting provision will be from LED low energy fittings achieving a minimum efficacy of 100 lamp lumens per circuit watt, an improvement of over 50% from AD-L 2013 performance levels.

3.6.10. Smart meters will be installed on all properties, providing:

- Real time information on energy use both in terms of consumption and cost
- Occupier can manage their energy, save money and reduce carbon emissions
- Smart meters will also allow for easier switching between suppliers
- Facilitate a more reactive, price driven, demand-response
- End estimated billing and eliminate the need for meter readers to visit premises

3.7. Water Use

3.7.1. The design team will implement a specification which complies with the optional requirement of 110 litres/person/day as set out in Approved Document G 2015 with 2016 amendments (AD-G).

3.7.2. The calculated results show that utilisation of the representative component's water consumption can achieve a maximum of 105 litres per person per day internally, and additional external water use of 5 litres per person per day.

3.7.3. While the build specifications are not yet set, the table below provides an example of a compliant strategy, delivering reduced water consumption of 110 litres/person/day.

		(1)	(2)	(3)	(4)
Installation type	**Unit of measure**	**Capacity / flow rate**	**Use factor**	**Fixed use (litres/ person/ day)**	**Litres/ person/day = [(1) × (2)] + (3)**
~~**WC** (single flush)~~	~~Flush volume (litres)~~	-	~~4.42~~	~~0.00~~	~~0~~
WC (dual flush)	Full flush volume (litres)	4	1.46	0.00	5.84
	Part flush volume (litres)	2.6	2.96	0.00	7.696
~~**WCs** (multiple fittings)~~	~~Average effective flushing volume (litres)~~	-	~~4.42~~	~~0.00~~	~~0~~
Taps (excluding kitchen/utility room taps)	Flow rate (litres/minute)	5	1.58	1.58	9.48
Bath (where shower also present)	Capacity to overflow (litres)	170	0.11	0.00	18.7
Shower (where bath also present)	Flow rate (litres/minute)	9	4.37	0.00	39.33
~~**Bath only**~~	~~Capacity to overflow (litres)~~	-	~~0.50~~	~~0.00~~	~~0~~
~~**Shower only**~~	~~Flow rate (litres/minute)~~	-	~~5.60~~	~~0.00~~	~~0~~
Kitchen/utility room sink taps	Flow rate (litres/minute)	5	0.44	10.36	12.56
Washing machine	Litres/kg dry load	8.17	2.1	0.00	17.157
Dishwasher	Litres/place setting	1.25	3.6	0.00	4.5
~~**Waste disposal unit**~~	~~Litres/use (If present = 1 If absent = 0)~~	~~0~~	~~3.08~~	~~0.00~~	~~0~~
~~**Water softener**~~	~~Litres/person/day~~	-	~~1.00~~	~~0.00~~	~~0~~
	(5)	**Total calculated use = (Sum column 4)**			115.3
	(6)	Contribution from greywater (litres/person/day) from Table 4.6			0
	(7)	Contribution from rainwater (litres/person/day) from Table 5.5			0
	(8)	Normalisation factor			0.91
	(9)	Total water consumption = [(5) – (6) – (7)] x (8)			104.9
	(10)	External water use			5.0
Approved Document G	**(11)**	**Total water consumption = (9) + (10) (litres/person/day)**			109.9

3.7.1. The development therefore complies with the requirement set out by the North Oxfordshire District Council.

4. Results

4.1. Carbon reduction

4.1.1 All 80 plots being built to Part L 2021 will use the following LZCT:

- Photovoltaic panels (excluding the maisonettes)
- Waste Water Heat Recovery (WWHR)
- Decentralised Mechanical Extract Ventilation (dMEV)
- Flue Gas Heat Recovery (FGHR)

4.1.2 Part L 2021 represents a minimum 31% uplift over Part L 2013. The below formula therefore assumes a minimum 31% uplift for the Part L 2021 plots, and a 0% uplift for the Part L 2013 plots. In reality, the uplift would be even higher, as this formula assumes minimum compliance rather than an improvement over the TER.

4.1.3 The figures calculated for the Part L1A 2013 averaged with those for Part L1A 2021 in the formula below result in the site achieving at least a 23.18% reduction in emissions from Part L 2013:

$$\frac{(80\ plots\ \times 31\%) + (27\ plots\ \times 0\%)}{107\ total\ plots} = 23.18\%\ reduction\ in\ carbon\ emissions$$

4.1.1 It can be concluded that a reduction of at least 23.18% in carbon emissions from Part L 2013 is achieved across the site.

4.1.2 The development therefore complies with the 19% uplift over Part L 2013 requirement set out by the North Oxfordshire District Council.

5. Conclusion

5.1.1. This energy statement has been produced to accompany the planning application for the proposed residential site of 107 dwellings at White Post Road, Bodicote, Oxfordshire.

5.1.2. The proposed LZC Technologies which will be present on all Part L 2021 plots are:

- Photovoltaic panels
- Waste Water Heat Recovery (WWHR)
- Decentralised Mechanical Extract Ventilation (dMEV)
- Flue Gas Heat Recovery (FGHR)

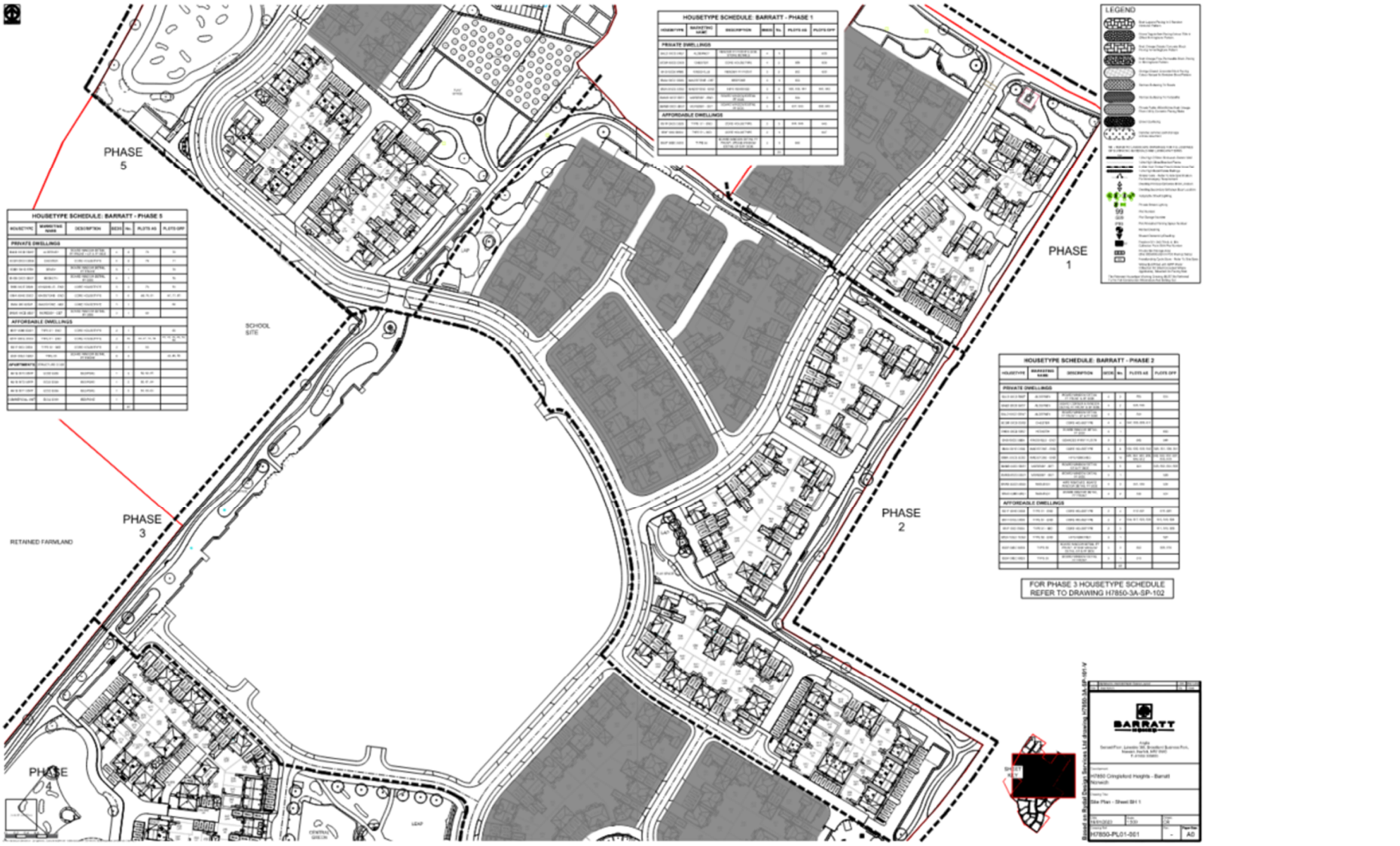
5.1.3. This allows the site to achieve a reduction in carbon emissions of a minimum 23.18% over Part L 2013, therefore meeting the 19% target set out by Condition 12 of Planning Permission 21/03639/F.

5.1.4. It should be noted that future policies and building regulations may require an update to the sustainability measures within this report.

5.1.5. It can therefore be seen that the proposed development will:

- *Incorporate recognised LZC technologies for the Part L 2021 plots*
- *Achieve a significant reduction in carbon emissions from these technologies*
- *Is therefore compliant with the requirement set out by the North Oxfordshire District Council as a reduction in carbon emissions of at least 23% beyond Part L 2013 is achieved across the site.*

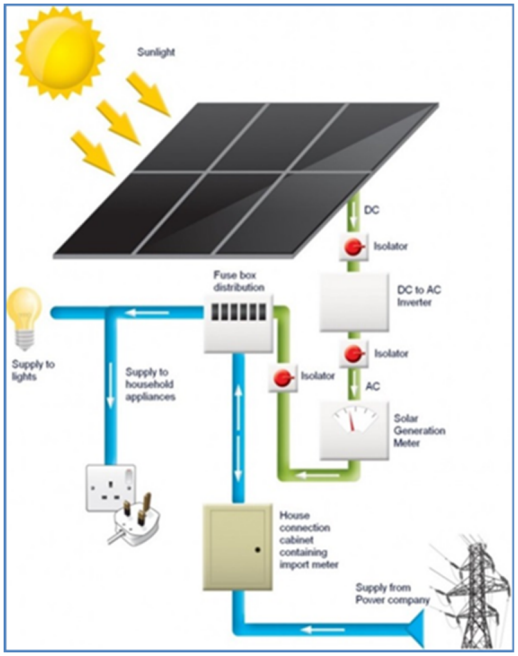
Appendix A – Site Plan



Appendix B - Low and Zero Carbon Technologies

Photovoltaic (PV) Cells

The efficiency of PV cells has improved rapidly over the last 15 years. This has made a previously uneconomical technology an increasingly viable solution to rising energy costs and demand. The cells can be produced in a variety of formats but are typically manufactured as a panel or a roof tile for domestic housing applications.



The PV system typically produces direct current (DC) which is then sent through an inverter to supply the house with electricity. If a greater amount of electricity is produced than used by the household, this extra can be exported to the national grid.

A PV cell is assessed on its peak power rating. This is tested by exposing the cell to the equivalent of full solar radiation and measuring the power output. The peak power is input into the Design SAP software as well as the physical attributes of the installation such as pitch, orientation and over-shading. A total energy saving per year can then be calculated through SAP for the PV installation. This is then offset against the electricity energy demand for the house.

Solar Hot Water (SHW)

SHW systems generate energy which is used to heat stored water (in a special solar hot water cylinder) which offsets the energy required for the boiler, thereby reducing fuel use and reducing carbon emissions. Therefore, SHW systems are ideally utilised when the design of a dwelling already calls for a hot water cylinder, and not when a combination boiler is specified.

There are two main SHW systems: evacuated tubes and flat plate collectors. Evacuated tubes are more efficient at transferring solar irradiation to the fluid although flat plate collectors are considered to be better aesthetically and to install.

The final energy contribution to the household, calculated through SAP, is based on several factors:

- *Pitch, orientation, and over-shading*
- *Heat absorption efficiency for the collector*
- *Average hot water usage of the dwelling*

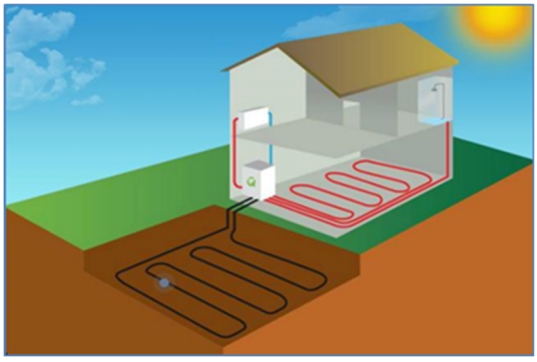
Most of the energy savings will be made in the hot water demand for the dwelling however, adding a SHW system will impact upon other energy demands.

Air Source Heat Pumps (ASHP)

ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling. Systems can be designed to work in conjunction with a boiler system but in the case of energy efficient new builds it is possible for an ASHP unit to provide 100% of the heating and hot water demand.

The thermal performance of the unit depends on the outside temperature as well as the unit's Coefficient of Performance. This is the ratio of thermal energy produced to energy used. A typical value for this would be around 3.5, meaning that for every 1kW of electricity consumed the unit would provide 3.5kW of thermal energy to the household. This efficiency leads to large carbon and energy savings for both space and water heating.

Ground Source Heat Pumps (GSHP)



GSHP provide heating and hot water to a dwelling through geothermal effects. A GSHP system would offset the energy demand from the main space heating. There is, however, an additional electricity demand for the pump and control system. This would reduce energy savings from the installation.

GSHP are expensive to install and rely on having appropriate ground conditions and suitable space around the dwelling for the pipe looping. Energy savings are dependent upon the type of system being replaced and the way the system is operated by the homeowner.

Biomass Heating Systems

Biomass heating systems burn fuels, considered carbon neutral, to heat the water required for a dwelling. There are a large variety of systems available, and choice depends on the type of fuel to be burned and the level of automation.

The system would offset the energy demand from the hot water and main space heating. However, biomass systems typically require a large amount of maintenance and monitoring.

The savings from such a system, in terms of CO2 and money, depends upon what it is replacing. The savings are greatest when replacing an electrical hot water system but are considerably less for replacing mains gas.

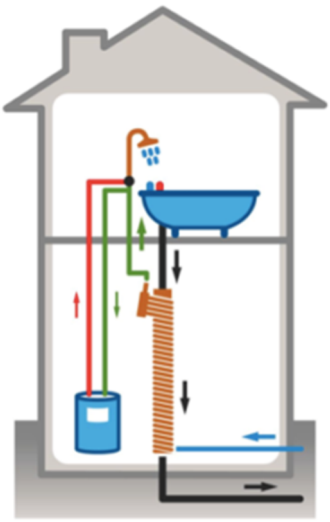
Wind Turbines

Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as to allow for efficient operation. The building mounted systems have a lower power output but do not require additional structures, as can be seen in figure

The energy produced from a wind turbine is heavily dependent upon the surrounding landscape. The energy saved will be offset against the electricity usage of the dwelling.

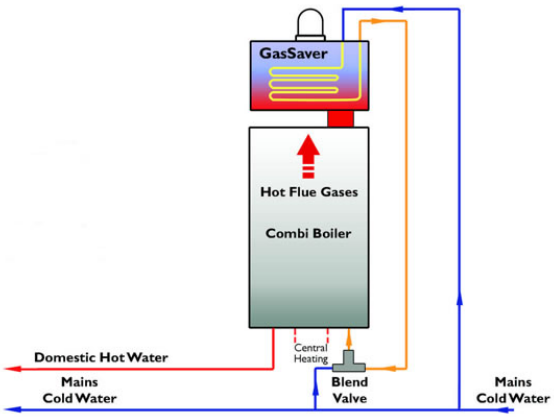
WWHRS

Waste water heat recovery system (WWHRS) recovers the energy that is lost from the waste water that is generated from showers. It uses a heat exchange system which recovers a portion of the energy that would normally be wasted. The waste heat is partially transferred to the incoming mains water inlet, which reduces the change in temperature required for the boiler to make. It therefore has the ability to reduce the amount energy required for the boiler to operate at specific points in the day.



FGHRS

Flue gas heat recovery system (FGHRS) works by recovering waste heat from the flue of a boiler. This waste heat is partially transferred to the main water inlet which raises the temperature of the water which is fed into the boiler. This reduces the amount of energy required to heat the boiler, as it reduces the temperature increase required for the boiler to operate, and therefore reduces the energy demand to heat the dwelling.



Appendix C – SAP Reports

SAP worksheets are found within the following pages

Full SAP Calculation Printout

Property Reference	Plot 117 P382 09NR SD	**Issued on Date**	18/03/2024
Assessment Reference	1	**Prop Type Ref**	1
Property	Plot 117, The Pavilions, Bodicote, OX5		

SAP Rating	90 B	**DER**	10.74	**TER**	12.05
Environmental	91 B	**% DER < TER**			10.87
CO_2 Emissions (t/year)	0.73	**DFEE**	35.75	**TFEE**	36.86
Compliance Check	See BREL	**% DFEE < TFEE**			3.01
% DPER < TPER	8.30	**DPER**	57.80	**TPER**	63.03

Assessor Details	Ms. Alina Spataru	**Assessor ID**	BD89-0001
Client	BDW Mercia, BDW Mercia		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000 (1b)	x	2.3100 (2b)	=	88.7040	(1b) - (3b)
First floor	38.4000 (1c)	x	2.5600 (2c)	=	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.0080	(5)

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2. Ventilation rate

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

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

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

Mechanical extract ventilation - decentralised

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16561.8398 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		215.6489 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.8500	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 6.8438 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 48.5571 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	(38)
Heat transfer coeff	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	(39)

Average = Sum(39)m / 12 = 79.4134

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	(40)
HLP (average)												1.0340	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3993 (42)

Hot water usage for mixer showers

64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day) 120.8679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)

Energy content (annual) Total = Sum(45)m = 2007.5909

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

31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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 5.4760	4.9364	5.4446	5.2250	5.3714	5.1700	5.3245	5.3392	5.1837	5.3888	5.2570	5.4702	(61)

Total heat required for water heating calculated for each month

213.7219	188.1766	197.9677	169.5849	161.3151	142.0281	137.8240	145.2087	148.9034	170.0146	185.6168	210.8157	(62)
WWHRS -57.3902	-50.7564	-53.1492	-44.0096	-41.0154	-35.0972	-32.8980	-34.9837	-36.3129	-42.8089	-48.4973	-56.3275	(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

156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)

Total per year (kWh/year) = Sum(64)m = 1537.9316 (64)

12Total per year (kWh/year) 1538 (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

70.6108	62.1615	65.3751	55.9559	53.1941	46.7978	45.3872	47.8414	49.0827	56.0853	61.2839	69.6449	(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	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	111.5988	123.5559	111.5988	115.3188	111.5988	115.3188	111.5988	111.5988	115.3188	111.5988	115.3188	111.5988	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)	94.9069	92.5022	87.8698	77.7166	71.4975	64.9970	61.0043	64.3030	68.1705	75.3835	85.1165	93.6088	(72)
Total internal gains	481.1188	492.8774	470.7280	452.4583	427.5778	407.7544	390.6603	391.7526	404.9000	423.2295	451.6240	470.4391	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	19.6403	0.7300	0.7000	0.7700	22.4649	(76)
North	1.4000	10.6334	0.7300	0.7000	0.7700	5.2717	(74)
East	3.4500	19.6403	0.7300	0.7000	0.7700	23.9950	(76)

West			4.3700		19.6403		0.7300	0.7000		0.7700		30.3937	(80)
Solar gains	82.1253	160.4163	264.7106	388.5952	479.5804	492.6714	468.3131	399.8449	308.5419	190.3856	102.3307	67.5954	(83)
Total gains	563.2441	653.2938	735.4387	841.0535	907.1583	900.4258	858.9734	791.5975	713.4419	613.6152	553.9546	538.0345	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	
alpha	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	
util living area	0.9910	0.9809	0.9560	0.8796	0.7346	0.5487	0.4037	0.4556	0.7053	0.9265	0.9823	0.9928	(86)
MIT	19.7682	19.9772	20.2808	20.6454	20.8843	20.9772	20.9958	20.9926	20.9282	20.5872	20.1023	19.7169	(87)
Th 2	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	(88)
util rest of house	0.9885	0.9759	0.9443	0.8502	0.6803	0.4739	0.3186	0.3649	0.6296	0.9013	0.9766	0.9908	(89)
MIT 2	18.6260	18.8902	19.2690	19.7035	19.9597	20.0417	20.0536	20.0522	20.0062	19.6479	19.0511	18.5608	(90)
Living area fraction									fLA = Living area / (4) =			0.2861	(91)
MIT	18.9527	19.2012	19.5584	19.9730	20.2242	20.3093	20.3231	20.3212	20.2700	19.9166	19.3518	18.8915	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8027	19.0512	19.4084	19.8230	20.0742	20.1593	20.1731	20.1712	20.1200	19.7666	19.2018	18.7415	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9840	0.9687	0.9344	0.8420	0.6815	0.4824	0.3293	0.3762	0.6352	0.8918	0.9697	0.9868	(94)
Useful gains	554.2222	632.8748	687.2046	708.1322	618.2130	434.3395	282.8807	297.8281	453.1682	547.2455	537.1818	530.9442	(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	1151.7106	1123.7932	1025.1007	867.4299	665.0224	441.4837	283.7528	299.4837	478.0680	727.9508	961.0473	1154.7914	(97)
Space heating kWh	444.5314	329.8971	251.3947	114.6943	34.8262	0.0000	0.0000	0.0000	0.0000	134.4448	305.1831	464.1423	(98a)
Space heating requirement - total per year (kWh/year)												2079.1139	
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	444.5314	329.8971	251.3947	114.6943	34.8262	0.0000	0.0000	0.0000	0.0000	134.4448	305.1831	464.1423	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2079.1139	
Space heating per m2											(98c) / (4) =	27.0718	(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 %)	89.0000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	444.5314	329.8971	251.3947	114.6943	34.8262	0.0000	0.0000	0.0000	0.0000	134.4448	305.1831	464.1423	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	499.4734	370.6709	282.4660	128.8700	39.1306	0.0000	0.0000	0.0000	0.0000	151.0615	342.9023	521.5082	(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	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.5514	88.4933	88.3710	88.1033	87.6760	87.3000	87.3000	87.3000	87.3000	88.1653	88.4659	88.5693	(217)
Fuel for water heating, kWh/month	176.5435	155.2889	163.8756	142.5318	137.2095	122.4868	120.1901	126.2600	128.9697	144.2810	154.9969	174.4264	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9352	8.9737	9.9352	9.6147	9.9352	9.6147	9.9352	9.9352	9.6147	9.9352	9.6147	9.9352	(231)
Lighting	21.4970	17.2457	15.5279	11.3764	8.7874	7.1794	8.0162	10.4197	13.5342	17.7576	20.0572	22.0945	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.2768	-17.1409	-29.5578	-39.0765	-46.7677	-45.3599	-44.4924	-39.3347	-31.0801	-21.5488	-12.0472	-8.5210	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3925	-5.9940	-14.6995	-26.5602	-39.2810	-41.1428	-40.0725	-31.3423	-19.7627	-9.3884	-3.3842	-1.8028	(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	2336.0830 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.3000
Water heating fuel used	1747.0604 (219)
Space cooling fuel	0.0000 (221)

Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.0240, total flow = 37.0000, SFP = 0.1358)		
mechanical ventilation fans (SFP = 0.1358)	30.9790	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	116.9790	(231)
Electricity for lighting (calculated in Appendix L)	173.4933	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-581.0267	(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	3792.5890	(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	2336.0830	0.2100	490.5774	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1747.0604	0.2100	366.8827	(264)
Space and water heating			857.4601	(265)
Pumps, fans and electric keep-hot	116.9790	0.1387	16.2264	(267)
Energy for lighting	173.4933	0.1443	25.0404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	0.1316	-45.4191	
PV Unit electricity exported	-235.8228	0.1216	-28.6704	
Total			-74.0895	(269)
Total CO2, kg/year			824.6375	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.7400	(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	2336.0830	1.1300	2639.7738	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1747.0604	1.1300	1974.1782	(278)
Space and water heating			4613.9520	(279)
Pumps, fans and electric keep-hot	116.9790	1.5128	176.9659	(281)
Energy for lighting	173.4933	1.5338	266.1098	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	1.4861	-513.0058	
PV Unit electricity exported	-235.8228	0.4460	-105.1879	
Total			-618.1938	(283)
Total Primary energy kWh/year			4438.8340	(286)
Dwelling Primary energy Rate (DPER)			57.8000	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000	(1b)	x 2.3100	(2b) =	88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c) =	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.0080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1604	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4104	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3489	(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													
	0.4448	0.4361	0.4274	0.3837	0.3750	0.3314	0.3314	0.3227	0.3489	0.3750	0.3925	0.4099	(22b)
Effective ac	0.5989	0.5951	0.5913	0.5736	0.5703	0.5549	0.5549	0.5521	0.5609	0.5703	0.5770	0.5840	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2500	1.0000	2.2500			(26)
TER Opening Type (Uw = 1.20)			12.4500	1.1450	14.2557			(27)
B&B 225mm TE Platinum GF			38.4000	0.1300	4.9920			(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.1800	12.7818			(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.1100	4.2240			(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5035			(33)
E-MW-22			38.9600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 215.6489 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0500	0.2720
E3 Sill	7.9900	0.0500	0.3995
E4 Jamb	19.2000	0.0500	0.9600
E5 Ground floor (normal)	17.6000	0.1600	2.8160
E6 Intermediate floor within a dwelling	17.6000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.6000	0.0600	0.5760
E12 Gable (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	9.7400	0.0900	0.8766
E18 Party wall between dwellings	9.7400	0.0600	0.5844
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600
E2 Other lintels (including other steel lintels)	5.1600	0.0500	0.2580
E4 Jamb	8.8500	0.0500	0.4425

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2650 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 47.7685 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.9610	36.7239	36.4916	35.4002	35.1960	34.2455	34.2455	34.0694	34.6116	35.1960	35.6091	36.0409	(38)
Heat transfer coeff	84.7295	84.4925	84.2601	83.1687	82.9645	82.0140	82.0140	81.8379	82.3801	82.9645	83.3776	83.8095	(39)
Average = Sum(39)m / 12 =												83.1677	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1032	1.1002	1.0971	1.0829	1.0803	1.0679	1.0679	1.0656	1.0727	1.0803	1.0856	1.0913	(40)
HLP (average)												1.0829	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3993 (42)

Hot water usage for mixer showers

64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day) 120.8679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5909	
Distribution loss (46)m = 0.15 x (45)m	31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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	259.2048	229.2677	243.4821	213.6750	206.9026	186.1732	183.4584	190.8284	193.0348	215.5848	229.6748	256.3044	(62)
WWHRS	-29.4633	-26.0576	-27.2860	-22.5939	-21.0567	-18.0183	-16.8893	-17.9601	-18.6425	-21.9774	-24.8977	-28.9177	(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	229.7415	203.2101	216.1961	191.0811	185.8460	168.1548	166.5691	172.8683	174.3923	193.6074	204.7771	227.3867	(64)
										Total per year (kWh/year) = Sum(64)m =		2333.8305	(64)
12Total per year (kWh/year)												2334	(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	81.9815	72.4342	76.7537	66.9784	64.5910	57.8341	56.7958	59.2463	60.1156	67.4778	72.2984	81.0171	(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	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
111.5988 123.5559 111.5988 115.3188 111.5988 115.3188 111.5988 111.5988 115.3188 111.5988 115.3188 111.5988 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
212.6229 214.8293 209.2693 197.4328 182.4914 168.4485 159.0670 156.8607 162.4206 174.2571 189.1986 203.2414 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 34.9967 (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)
-95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 -95.9736 (71)
Water heating gains (Table 5)
110.1902 107.7891 103.1636 93.0256 86.8159 80.3251 76.3384 79.6322 83.4938 90.6960 100.4144 108.8940 (72)
Total internal gains
496.4020 508.1643 486.0218 467.7673 442.8962 423.0826 405.9944 407.0818 420.2234 438.5421 466.9219 485.7243 (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	1.4000	10.6334	0.6300	0.7000	0.7700	4.5496	(74)
East	6.8800	19.6403	0.6300	0.7000	0.7700	40.0955	(76)
West	4.3700	19.6403	0.6300	0.7000	0.7700	26.2301	(80)

Solar gains 70.8752 138.4415 228.4489 335.3630 413.8845 425.1822 404.1606 345.0716 266.2759 164.3054 88.3128 58.3357 (83)
Total gains 567.2773 646.6058 714.4707 803.1303 856.7807 848.2647 810.1550 752.1534 686.4993 602.8475 555.2347 544.0601 (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	54.2964	54.4488	54.5989	55.3154	55.4515	56.0942	56.0942	56.2149	55.8449	55.4515	55.1768	54.8925	
alpha	4.6198	4.6299	4.6399	4.6877	4.6968	4.7396	4.7396	4.7477	4.7230	4.6968	4.6785	4.6595	
util living area	0.9912	0.9830	0.9638	0.9029	0.7787	0.5929	0.4400	0.4910	0.7396	0.9357	0.9831	0.9927	(86)
MIT	19.6519	19.8535	20.1560	20.5536	20.8342	20.9650	20.9930	20.9886	20.9034	20.5255	20.0272	19.6244	(87)
Th 2	19.9982	20.0007	20.0032	20.0148	20.0170	20.0271	20.0271	20.0290	20.0232	20.0170	20.0126	20.0080	(88)
util rest of house	0.9887	0.9783	0.9537	0.8768	0.7253	0.5127	0.3454	0.3919	0.6630	0.9124	0.9776	0.9906	(89)
MIT 2	18.4377	18.6948	19.0761	19.5661	19.8772	20.0063	20.0247	20.0245	19.9563	19.5457	18.9257	18.4097	(90)
Living area fraction										fLA = Living area / (4) =		0.2861	(91)
MIT	18.7850	19.0263	19.3850	19.8486	20.1510	20.2805	20.3017	20.3003	20.2272	19.8260	19.2408	18.7572	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7850	19.0263	19.3850	19.8486	20.1510	20.2805	20.3017	20.3003	20.2272	19.8260	19.2408	18.7572	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9846	0.9723	0.9458	0.8717	0.7332	0.5343	0.3725	0.4202	0.6803	0.9069	0.9719	0.9870	(94)
Useful gains	558.5320	628.6900	675.7622	700.0611	628.1733	453.2107	301.7715	316.0321	466.9942	546.7282	539.6217	536.9883	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1227.3069	1193.5621	1085.6943	910.5806	701.1304	465.8843	303.5891	319.1946	504.7616	765.4269	1012.2689	1220.0278	(97)
Space heating kWh	497.5686	379.5940	304.9894	151.5741	54.2801	0.0000	0.0000	0.0000	0.0000	162.7119	340.3060	508.1814	(98a)
Space heating requirement - total per year (kWh/year)												2399.2054	
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	497.5686	379.5940	304.9894	151.5741	54.2801	0.0000	0.0000	0.0000	0.0000	162.7119	340.3060	508.1814	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2399.2054	
Space heating per m2											(98c) / (4) =	31.2397	(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	497.5686	379.5940	304.9894	151.5741	54.2801	0.0000	0.0000	0.0000	0.0000	162.7119	340.3060	508.1814	(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)	538.4941	410.8160	330.0752	164.0412	58.7447	0.0000	0.0000	0.0000	0.0000	176.0951	368.2965	549.9799	(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	229.7415	203.2101	216.1961	191.0811	185.8460	168.1548	166.5691	172.8683	174.3923	193.6074	204.7771	227.3867	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.9909	85.6997	85.1185	83.8898	82.0952	80.3000	80.3000	80.3000	80.3000	84.0112	85.4615	86.0511	(217)
Fuel for water heating, kWh/month	267.1695	237.1187	253.9942	227.7762	226.3786	209.4083	207.4334	215.2781	217.1759	230.4543	239.6133	264.2463	(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	23.1880	18.6023	16.7493	12.2713	9.4787	7.7442	8.6468	11.2394	14.5989	19.1545	21.6350	23.8325	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.8884	-50.5742	-72.6671	-81.6750	-88.0509	-82.1819	-81.1681	-76.6382	-68.6371	-57.8183	-39.4483	-31.0304	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.3367	-42.7779	-85.0183	-127.6829	-168.8199	-169.6197	-167.6212	-141.9262	-104.0318	-61.1709	-27.1510	-16.0818	(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	2596.5426	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2796.0468	(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)	187.1407	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1898.0163	(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	3767.7139	(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	2596.5426	0.2100	545.2740	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2796.0468	0.2100	587.1698	(264)
Space and water heating			1132.4438	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	187.1407	0.1443	27.0102	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-765.7778	0.1346	-103.0686	
PV Unit electricity exported	-1132.2385	0.1259	-142.5470	
Total			-245.6156	(269)
Total CO2, kg/year			925.7677	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.0500	(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	2596.5426	1.1300	2934.0932	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2796.0468	1.1300	3159.5329	(278)
Space and water heating			6093.6261	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	187.1407	1.5338	287.0427	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-765.7778	1.4974	-1146.7022	
PV Unit electricity exported	-1132.2385	0.4621	-523.2456	
Total			-1669.9478	(283)
Total Primary energy kWh/year			4840.8218	(286)
Target Primary Energy Rate (TPER)			63.0300	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000	(1b)	x 2.3100	(2b)	= 88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c)	= 98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 187.0080	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	3 * 10 =	30.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1604	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3604	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3064	(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	0.3906	0.3829	0.3753	0.3370	0.3293	0.2910	0.2910	0.2834	0.3064	0.3293	0.3447	0.3600	(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	0.5763	0.5733	0.5704	0.5568	0.5542	0.5424	0.5424	0.5402	0.5469	0.5542	0.5594	0.5648	(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	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16561.8398 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		215.6489 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.5000	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.8438 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.5571 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.5642	35.3814	35.2022	34.3605	34.2030	33.4700	33.4700	33.3342	33.7523	34.2030	34.5216	34.8546	(38)
Heat transfer coeff	84.1212	83.9384	83.7592	82.9176	82.7601	82.0270	82.0270	81.8913	82.3094	82.7601	83.0787	83.4117	(39)
Average = Sum(39)m / 12 =												82.9168	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0953	1.0929	1.0906	1.0797	1.0776	1.0681	1.0681	1.0663	1.0717	1.0776	1.0818	1.0861	(40)
HLP (average)												1.0796	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3993 (42)

Hot water usage for mixer showers

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

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day)	61.4483 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	67.0399	65.2010	63.1933	60.6943	58.4649	56.1481	55.6667	57.6703	59.7253	62.1046	64.6257	66.9458	(44)
Energy conte	106.1749	92.8453	97.1257	83.0874	78.7050	69.0407	67.3240	71.4079	73.6473	84.2753	92.0711	104.8210	(45)
Energy content (annual)										Total = Sum(45)m =		1020.5256	

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:
Total storage loss

	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													
	90.2486	78.9185	82.5568	70.6243	66.8993	58.6846	57.2254	60.6967	62.6002	71.6340	78.2604	89.0978	(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													
	90.2486	78.9185	82.5568	70.6243	66.8993	58.6846	57.2254	60.6967	62.6002	71.6340	78.2604	89.0978	(64)
										Total per year (kWh/year) = Sum(64)m =		867.4468	(64)
12Total per year (kWh/year)												867	(64)
Electric shower(s)													
	51.6127	45.9873	50.2164	47.9209	48.8201	46.5697	48.1220	48.8201	47.9209	50.2164	49.2721	51.6127	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		587.0914	(64a)
Heat gains from water heating, kWh/month													
	35.4653	31.2265	33.1933	29.6363	28.9299	26.3136	26.3369	27.3792	27.6303	30.4626	31.8831	35.1776	(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	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.5988	123.5559	111.5988	115.3188	111.5988	115.3188	111.5988	111.5988	115.3188	111.5988	115.3188	111.5988	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	47.6685	46.4680	44.6147	41.1615	38.8842	36.5466	35.3990	36.8000	38.3754	40.9444	44.2822	47.2818	(72)
Total internal gains													
	430.8803	443.8432	424.4729	412.9033	391.9645	379.3040	365.0550	364.2496	375.1049	385.7904	407.7896	421.1121	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	19.6403	0.7300	0.7000	0.7700	22.4649	(76)
North	1.4000	10.6334	0.7300	0.7000	0.7700	5.2717	(74)
East	3.4500	19.6403	0.7300	0.7000	0.7700	23.9950	(76)
West	4.3700	19.6403	0.7300	0.7000	0.7700	30.3937	(80)

Solar gains	82.1253	160.4163	264.7106	388.5952	479.5804	492.6714	468.3131	399.8449	308.5419	190.3856	102.3307	67.5954	(83)
Total gains	513.0056	604.2595	689.1836	801.4984	871.5450	871.9754	833.3681	764.0945	683.6468	576.1761	510.1203	488.7075	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6891	54.8082	54.9254	55.4829	55.5885	56.0853	56.0853	56.1783	55.8929	55.5885	55.3754	55.1543	
alpha	4.6459	4.6539	4.6617	4.6989	4.7059	4.7390	4.7390	4.7452	4.7262	4.7059	4.6917	4.6770	
util living area													
	0.9941	0.9868	0.9679	0.9030	0.7699	0.5792	0.4284	0.4841	0.7413	0.9444	0.9878	0.9953	(86)
MIT	19.5829	19.8036	20.1322	20.5559	20.8432	20.9682	20.9938	20.9892	20.9027	20.4968	19.9664	19.5484	(87)
Th 2	20.0047	20.0066	20.0085	20.0175	20.0192	20.0270	20.0270	20.0285	20.0240	20.0192	20.0158	20.0122	(88)
util rest of house													
	0.9924	0.9831	0.9587	0.8769	0.7160	0.5000	0.3360	0.3862	0.6648	0.9235	0.9837	0.9939	(89)
MIT 2	18.7188	18.9388	19.2624	19.6695	19.9167	20.0124	20.0253	20.0252	19.9713	19.6259	19.1087	18.6903	(90)
Living area fraction										fLA = Living area / (4) =		0.2861	(91)
MIT	18.9660	19.1862	19.5112	19.9231	20.1817	20.2858	20.3023	20.3009	20.2378	19.8750	19.3540	18.9357	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9660	19.1862	19.5112	19.9231	20.1817	20.2858	20.3023	20.3009	20.2378	19.8750	19.3540	18.9357	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9900	0.9791	0.9531	0.8740	0.7256	0.5217	0.3625	0.4142	0.6829	0.9197	0.9801	0.9919	(94)
Useful gains	507.8864	591.6513	656.8477	700.5017	632.3758	454.8914	302.0722	316.4684	466.8414	529.9223	499.9733	484.7457	(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													
	1233.7230	1199.1604	1089.8084	914.0058	701.9485	466.3891	303.6915	319.4536	505.1947	767.6009	1018.0489	1229.1337	(97)
Space heating kWh													
	540.0224	408.2461	322.1228	153.7229	51.7620	0.0000	0.0000	0.0000	0.0000	176.8329	373.0144	553.8247	(98a)
Space heating requirement - total per year (kWh/year)												2579.5484	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	540.0224	408.2461	322.1228	153.7229	51.7620	0.0000	0.0000	0.0000	0.0000	176.8329	373.0144	553.8247	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2579.5484	
Space heating per m2											(98c) / (4) =	33.5879	(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	771.0542	607.0001	622.3738	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9066	0.9498	0.9272	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	699.0136	576.5062	577.0925	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	973.3586	930.5245	851.7682	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	197.5284	263.3896	204.3587	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction											fC = cooled area / (4) =	1.0000	(105)
Intermittency factor (Table 10b)													
	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	49.3821	65.8474	51.0897	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												166.3192	(107)
Energy for space heating												33.5879	(99)
Energy for space cooling												2.1656	(108)
Total												35.7535	(109)
Fabric Energy Efficiency (DFEE)												35.8	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000	(1b)	x 2.3100	(2b) =	88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c) =	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.0080	(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) =	0.1604 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		5.0000 (17)
Infiltration rate		0.4104 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3489 (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													
	0.4448	0.4361	0.4274	0.3837	0.3750	0.3314	0.3314	0.3227	0.3489	0.3750	0.3925	0.4099	(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	0.5989	0.5951	0.5913	0.5736	0.5703	0.5549	0.5549	0.5521	0.5609	0.5703	0.5770	0.5840	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2500	1.0000	2.2500			(26)
TER Opening Type (Uw = 1.20)			12.4500	1.1450	14.2557			(27)
B&B 225mm TE Platinum GF			38.4000	0.1300	4.9920			(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.1800	12.7818			(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.1100	4.2240			(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.5035			(33)
E-MW-22			38.9600	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 215.6489 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	5.4400	0.0500	0.2720
E3	Sill	7.9900	0.0500	0.3995
E4	Jamb	19.2000	0.0500	0.9600
E5	Ground floor (normal)	17.6000	0.1600	2.8160
E6	Intermediate floor within a dwelling	17.6000	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	9.6000	0.0600	0.5760
E12	Gable (insulation at ceiling level)	8.0000	0.0600	0.4800

E16 Corner (normal)	9.7400	0.0900	0.8766	
E18 Party wall between dwellings	9.7400	0.0600	0.5844	
P1 Party wall - Ground floor	8.0000	0.0800	0.6400	
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000	
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600	
E2 Other lintels (including other steel lintels)	5.1600	0.0500	0.2580	
E4 Jamb	8.8500	0.0500	0.4425	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2650 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 47.7685 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.9610	36.7239	36.4916	35.4002	35.1960	34.2455	34.2455	34.0694	34.6116	35.1960	35.6091	36.0409	(38)
Heat transfer coeff	84.7295	84.4925	84.2601	83.1687	82.9645	82.0140	82.0140	81.8379	82.3801	82.9645	83.3776	83.8095	(39)
Average = Sum(39)m / 12 =												83.1677	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1032	1.1002	1.0971	1.0829	1.0803	1.0679	1.0679	1.0656	1.0727	1.0803	1.0856	1.0913	(40)
HLP (average)												1.0829	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3993 (42)
Hot water usage for mixer showers

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day) 61.4483 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	67.0399	65.2010	63.1933	60.6943	58.4649	56.1481	55.6667	57.6703	59.7253	62.1046	64.6257	66.9458	(44)
Energy conte	106.1749	92.8453	97.1257	83.0874	78.7050	69.0407	67.3240	71.4079	73.6473	84.2753	92.0711	104.8210	(45)
Energy content (annual)										Total = Sum(45)m =		1020.5256	
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													
	90.2486	78.9185	82.5568	70.6243	66.8993	58.6846	57.2254	60.6967	62.6002	71.6340	78.2604	89.0978	(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													
	90.2486	78.9185	82.5568	70.6243	66.8993	58.6846	57.2254	60.6967	62.6002	71.6340	78.2604	89.0978	(64)
										Total per year (kWh/year) = Sum(64)m =		867.4468	(64)
12Total per year (kWh/year)												867	(64)
Electric shower(s)													
	51.6127	45.9873	50.2164	47.9209	48.8201	46.5697	48.1220	48.8201	47.9209	50.2164	49.2721	51.6127	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		587.0914	(64a)
Heat gains from water heating, kWh/month													
	35.4653	31.2265	33.1933	29.6363	28.9299	26.3136	26.3369	27.3792	27.6303	30.4626	31.8831	35.1776	(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	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	119.9670	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	111.5988	123.5559	111.5988	115.3188	111.5988	115.3188	111.5988	111.5988	115.3188	111.5988	115.3188	111.5988	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	212.6229	214.8293	209.2693	197.4328	182.4914	168.4485	159.0670	156.8607	162.4206	174.2571	189.1986	203.2414	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	34.9967	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	47.6685	46.4680	44.6147	41.1615	38.8842	36.5466	35.3990	36.8000	38.3754	40.9444	44.2822	47.2818	(72)
Total internal gains													
	430.8803	443.8432	424.4729	412.9033	391.9645	379.3040	365.0550	364.2496	375.1049	385.7904	407.7896	421.1121	(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	1.4000	10.6334	0.6300	0.7000	0.7700	4.5496	(74)
East	6.6800	19.6403	0.6300	0.7000	0.7700	40.0955	(76)
West	4.3700	19.6403	0.6300	0.7000	0.7700	26.2301	(80)

Solar gains	70.8752	138.4415	228.4489	335.3630	413.8845	425.1822	404.1606	345.0716	266.2759	164.3054	88.3128	58.3357	(83)
Total gains	501.7555	582.2847	652.9218	748.2662	805.8490	804.4862	769.2156	709.3212	641.3808	550.0959	496.1024	479.4479	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.2964	54.4488	54.5989	55.3154	55.4515	56.0942	56.0942	56.2149	55.8449	55.4515	55.1768	54.8925	
alpha	4.6198	4.6299	4.6399	4.6877	4.6968	4.7396	4.7396	4.7477	4.7230	4.6968	4.6785	4.6595	
util living area													
	0.9946	0.9887	0.9738	0.9215	0.8061	0.6197	0.4621	0.5181	0.7720	0.9526	0.9891	0.9956	(86)
MIT	19.5519	19.7587	20.0724	20.4970	20.8062	20.9580	20.9914	20.9857	20.8834	20.4618	19.9397	19.5250	(87)
Th 2	19.9982	20.0007	20.0032	20.0148	20.0170	20.0271	20.0271	20.0290	20.0232	20.0170	20.0126	20.0080	(88)
util rest of house													
	0.9931	0.9854	0.9661	0.8989	0.7551	0.5378	0.3634	0.4148	0.6975	0.9341	0.9855	0.9944	(89)
MIT 2	18.6831	18.8900	19.2006	19.6150	19.8875	20.0073	20.0247	20.0246	19.9587	19.5922	19.0800	18.6638	(90)
Living area fraction										fLA = Living area / (4) =		0.2861	(91)
MIT	18.9316	19.1385	19.4500	19.8673	20.1503	20.2793	20.3013	20.2995	20.2232	19.8409	19.3259	18.9102	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9316	19.1385	19.4500	19.8673	20.1503	20.2793	20.3013	20.2995	20.2232	19.8409	19.3259	18.9102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9908	0.9818	0.9608	0.8949	0.7626	0.5599	0.3917	0.4443	0.7142	0.9300	0.9820	0.9925	(94)
Useful gains	497.1519	571.6668	627.3060	669.6473	614.5574	450.4030	301.3049	315.1307	458.0635	511.6062	487.1885	475.8358	(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													
	1239.7311	1203.0457	1091.1716	912.1395	701.0739	465.7803	303.5564	319.1300	504.4311	766.6705	1019.3669	1232.8515	(97)
Space heating kWh													
	552.4790	424.2867	345.1160	174.5944	64.3683	0.0000	0.0000	0.0000	0.0000	189.7679	383.1685	563.2196	(98a)
Space heating requirement - total per year (kWh/year)												2697.0003	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	552.4790	424.2867	345.1160	174.5944	64.3683	0.0000	0.0000	0.0000	0.0000	189.7679	383.1685	563.2196	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2697.0003	
Space heating per m2											(98c) / (4) =	35.1172	(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	770.9314	606.9034	621.9684	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8810	0.9337	0.9077	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	679.2114	566.6465	564.5819	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	894.4751	855.5410	787.7474	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	154.9899	214.9375	166.0352	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	38.7475	53.7344	41.5088	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												133.9907	(107)
Energy for space heating												35.1172	(99)
Energy for space cooling												1.7447	(108)
Total												36.8619	(109)
Fabric Energy Efficiency (TFEE)												36.9	(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)	
Ground floor	38.4000	(1b)	x 2.3100	(2b) =	88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c) =	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.0080	(5)

2. Ventilation rate

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

Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1700	(21)

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

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16561.8398	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	215.6489	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.8500	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8438	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 48.5571	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	(38)
Heat transfer coeff	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	(39)
Average = Sum(39)m / 12 =												79.4134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	(40)
HLP (average)												1.0340	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3993	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day)	120.8679	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5909	
Distribution loss (46)m = 0.15 x (45)m	31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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	5.4760	4.9364	5.4446	5.2250	5.3714	5.1700	5.3245	5.3392	5.1837	5.3888	5.2570	5.4702	(61)
Total heat required for water heating calculated for each month	213.7219	188.1766	197.9677	169.5849	161.3151	142.0281	137.8240	145.2087	148.9034	170.0146	185.6168	210.8157	(62)
WWHRS	-57.3902	-50.7564	-53.1492	-44.0096	-41.0154	-35.0972	-32.8980	-34.9837	-36.3129	-42.8089	-48.4973	-56.3275	(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													

	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882 (64)
									Total per year (kWh/year) = Sum(64)m =			1537.9316 (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												
	70.6108	62.1615	65.3751	55.9559	53.1941	46.7978	45.3872	47.8414	49.0827	56.0853	61.2839	69.6449 (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	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5598	21.8138	17.7402	13.4304	10.0394	8.4757	9.1583	11.9043	15.9779	20.2876	23.6786	25.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	317.3476	320.6407	312.3422	294.6758	272.3752	251.4157	237.4135	234.1204	242.4189	260.0853	282.3859	303.3454	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	94.9069	92.5022	87.8698	77.7166	71.4975	64.9970	61.0043	64.3030	68.1705	75.3835	85.1165	93.6088	(72)
Total internal gains													
	539.5965	537.7389	520.7343	488.6050	456.6943	424.6706	407.3583	410.1099	426.3494	458.5385	493.9632	524.9787	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	19.6403	0.7300	0.7000	0.7700	22.4649	(76)
North	1.4000	10.6334	0.7300	0.7000	0.7700	5.2717	(74)
East	3.4500	19.6403	0.7300	0.7000	0.7700	23.9950	(76)
West	4.3700	19.6403	0.7300	0.7000	0.7700	30.3937	(80)

Solar gains	82.1253	160.4163	264.7106	388.5952	479.5804	492.6714	468.3131	399.8449	308.5419	190.3856	102.3307	67.5954	(83)
Total gains	621.7218	698.1552	785.4450	877.2002	936.2747	917.3420	875.6714	809.9547	734.8913	648.9242	596.2939	592.5741	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	
alpha	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	
util living area													
	0.9865	0.9753	0.9446	0.8649	0.7188	0.5396	0.3963	0.4458	0.6902	0.9123	0.9763	0.9892	(86)
MIT	19.8566	20.0415	20.3432	20.6756	20.8949	20.9787	20.9961	20.9932	20.9347	20.6249	20.1633	19.8003	(87)
Th 2	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	(88)
util rest of house													
	0.9829	0.9690	0.9307	0.8335	0.6640	0.4657	0.3126	0.3568	0.6144	0.8838	0.9691	0.9863	(89)
MIT 2	18.7378	18.9704	19.3441	19.7366	19.9691	20.0427	20.0537	20.0525	20.0111	19.6901	19.1270	18.6665	(90)
Living area fraction									fLA = Living area / (4) =			0.2861	(91)
MIT	19.0578	19.2768	19.6299	20.0052	20.2339	20.3104	20.3233	20.3216	20.2753	19.9575	19.4234	18.9909	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9078	19.1268	19.4799	19.8552	20.0839	20.1604	20.1733	20.1716	20.1253	19.8075	19.2734	18.8409	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9609	0.9203	0.8260	0.6658	0.4741	0.3231	0.3679	0.6204	0.8749	0.9611	0.9811	(94)
Useful gains	607.4501	670.8464	722.8687	724.5425	623.3897	434.9358	282.9654	298.0126	455.9389	567.7267	573.1238	581.3938	(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													
	1160.0582	1129.8005	1030.7766	869.9909	665.7964	441.5739	283.7672	299.5142	478.4873	731.2012	966.7345	1162.6815	(97)
Space heating kWh													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98a)
Space heating requirement - total per year (kWh/year)												1922.4173	
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													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1922.4173	
Space heating per m2											(98c) / (4) =	25.0315	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													

	461.9555	346.5361	257.3972	117.6662	35.4501	0.0000	0.0000	0.0000	0.0000	136.6573	318.4266	485.9305 (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												
	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882 (64)
Efficiency of water heater												87.3000 (216)
(217)m	88.5251	88.4690	88.3338	88.0649	87.6478	87.3000	87.3000	87.3000	87.3000	88.1227	88.4384	88.5462 (217)
Fuel for water heating, kWh/month												
	176.5959	155.3315	163.9448	142.5940	137.2535	122.4868	120.1901	126.2600	128.9697	144.3507	155.0451	174.4719 (219)
Space cooling fuel requirement												
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	9.9352	8.9737	9.9352	9.6147	9.9352	9.6147	9.9352	9.9352	9.6147	9.9352	9.6147	9.9352 (231)
Lighting	21.4970	17.2457	15.5279	11.3764	8.7874	7.1794	8.0162	10.4197	13.5342	17.7576	20.0572	22.0945 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-10.2768	-17.1409	-29.5578	-39.0765	-46.7677	-45.3599	-44.4924	-39.3347	-31.0801	-21.5488	-12.0472	-8.5210 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	-2.3925	-5.9940	-14.6995	-26.5602	-39.2810	-41.1428	-40.0725	-31.3423	-19.7627	-9.3884	-3.3842	-1.8028 (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	2160.0195 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	87.3000
Water heating fuel used	1747.4941 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 5.0240, total flow = 37.0000, SFP = 0.1358)	
mechanical ventilation fans (SFP = 0.1358)	30.9790 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	116.9790 (231)
Electricity for lighting (calculated in Appendix L)	173.4933 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-581.0267 (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	3616.9592 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2160.0195	3.6400	78.6247	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1747.4941	3.6400	63.6088	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	116.9790	16.4900	19.2898	(249)
Energy for lighting	173.4933	16.4900	28.6090	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	16.4900	-56.9241	
PV Unit electricity exported	-235.8228	5.5900	-13.1825	
Total			-70.1066	(252)
Total energy cost			212.0258	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6267 (257)
SAP value		89.8416
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	2160.0195	0.2100	453.6041	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1747.4941	0.2100	366.9738	(264)
Space and water heating			820.5778	(265)
Pumps, fans and electric keep-hot	116.9790	0.1387	16.2264	(267)
Energy for lighting	173.4933	0.1443	25.0404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	0.1316	-45.4191	
PV Unit electricity exported	-235.8228	0.1216	-28.6704	
Total			-74.0895	(269)

Total CO2, kg/year	787.7553	(272)
CO2 emissions per m2	10.2600	(273)
EI value	91.3334	
EI rating	91	(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)	
Ground floor	38.4000	(1b)	x 2.3100	(2b) =	88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c) =	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.0080	(5)

2. Ventilation rate

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.1000	4.1000	3.9000	3.8000	3.2000	3.2000	3.2000	3.3000	3.8000	3.7000	3.9000	(22)
Wind factor	1.1500	1.0250	1.0250	0.9750	0.9500	0.8000	0.8000	0.8000	0.8250	0.9500	0.9250	0.9750	(22a)
Adj infilt rate	0.1955	0.1742	0.1742	0.1658	0.1615	0.1360	0.1360	0.1360	0.1403	0.1615	0.1573	0.1658	(22b)

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 16561.8398	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	215.6489	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.8500	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8438	(36)
Point Thermal bridges (36a) =	0.0000	

Total fabric heat loss (33) + (36) + (36a) = 48.5571 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	(38)
Heat transfer coeff	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	(39)
Average = Sum(39)m / 12 =												79.4134	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	(40)
HLP (average)												1.0340	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3993 (42)

Hot water usage for mixer showers

64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day) 120.8679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5909	

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

31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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)
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)
5.4760	4.9364	5.4446	5.2250	5.3714	5.1700	5.3245	5.3392	5.1837	5.3888	5.2570	5.4702	(61)

Primary loss, Combi loss

Total heat required for water heating calculated for each month

213.7219	188.1766	197.9677	169.5849	161.3151	142.0281	137.8240	145.2087	148.9034	170.0146	185.6168	210.8157	(62)
-57.3902	-50.7564	-53.1492	-44.0096	-41.0154	-35.0972	-32.8980	-34.9837	-36.3129	-42.8089	-48.4973	-56.3275	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS, PV diverter, Solar input, FGHRS

Output from w/h

156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
								Total per year (kWh/year) = Sum(64)m =			1537.9316	(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

70.6108	62.1615	65.3751	55.9559	53.1941	46.7978	45.3872	47.8414	49.0827	56.0853	61.2839	69.6449	(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	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5598	21.8138	17.7402	13.4304	10.0394	8.4757	9.1583	11.9043	15.9779	20.2876	23.6786	25.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.3476	320.6407	312.3422	294.6758	272.3752	251.4157	237.4135	234.1204	242.4189	260.0853	282.3859	303.3454	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	(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)	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)	94.9069	92.5022	87.8698	77.7166	71.4975	64.9970	61.0043	64.3030	68.1705	75.3835	85.1165	93.6088	(72)
Total internal gains	539.5965	537.7389	520.7343	488.6050	456.6943	424.6706	407.3583	410.1099	426.3494	458.5385	493.9632	524.9787	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	23.8568	0.7300	0.7000	0.7700	27.2878	(76)
North	1.4000	12.8108	0.7300	0.7000	0.7700	6.3512	(74)
East	3.4500	23.8568	0.7300	0.7000	0.7700	29.1464	(76)
West	4.3700	23.8568	0.7300	0.7000	0.7700	36.9187	(80)

Solar gains	99.7041	173.1085	275.6657	411.3295	491.7282	541.7466	502.8251	437.5928	340.2751	210.9929	119.3336	79.3531	(83)
Total gains	639.3007	710.8473	796.4000	899.9346	948.4225	966.4172	910.1833	847.7026	766.6245	669.5314	613.2968	604.3319	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	
alpha	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	
util living area	0.9825	0.9702	0.9316	0.8282	0.6602	0.4389	0.2961	0.3361	0.6051	0.8819	0.9689	0.9867	(86)

MIT	19.9568	20.1192	20.4322	20.7562	20.9343	20.9926	20.9992	20.9985	20.9671	20.7116	20.2590	19.8803	(87)
Th 2	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	(88)
util rest of house													
	0.9778	0.9625	0.9143	0.7900	0.5989	0.3643	0.2141	0.2485	0.5219	0.8447	0.9592	0.9831	(89)
MIT 2	18.8647	19.0680	19.4526	19.8258	20.0056	20.0516	20.0549	20.0547	20.0360	19.7881	19.2465	18.7682	(90)
Living area fraction										fLA = Living area / (4) =		0.2861	(91)
MIT	19.1771	19.3687	19.7328	20.0919	20.2713	20.3208	20.3250	20.3247	20.3023	20.0522	19.5362	19.0863	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0271	19.2187	19.5828	19.9419	20.1213	20.1708	20.1750	20.1747	20.1523	19.9022	19.3862	18.9363	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9710	0.9537	0.9039	0.7849	0.6034	0.3736	0.2245	0.2597	0.5308	0.8376	0.9504	0.9773	(94)
Useful gains	620.7576	677.9490	719.8515	706.3789	572.2793	361.0346	204.3798	220.1133	406.9597	560.8286	582.8535	590.5984	(95)
Ext temp.	4.9000	5.4000	7.2000	9.7000	12.6000	15.6000	17.6000	17.4000	14.9000	11.3000	7.7000	4.7000	(96)
Heat loss rate W													
	1121.8802	1097.3895	983.3610	813.3479	597.2919	362.9800	204.4913	220.3464	417.1069	683.1336	928.0379	1130.5548	(97)
Space heating kWh													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98a)
Space heating requirement - total per year (kWh/year)												1687.6325	
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													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1687.6325	
Space heating per m2											(98c) / (4) =	21.9744	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	418.9160	316.7011	220.2822	86.5367	20.9094	0.0000	0.0000	0.0000	0.0000	102.2415	279.2503	451.3792	(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													
	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4909	88.4356	88.2697	87.9386	87.5240	87.3000	87.3000	87.3000	87.3000	88.0010	88.3880	88.5212	(217)
Fuel for water heating, kWh/month													
	176.6641	155.3902	164.0637	142.7989	137.4478	122.4868	120.1901	126.2600	128.9697	144.5504	155.1336	174.5211	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9352	8.9737	9.9352	9.6147	9.9352	9.6147	9.9352	9.9352	9.6147	9.9352	9.6147	9.9352	(231)
Lighting	21.4970	17.2457	15.5279	11.3764	8.7874	7.1794	8.0162	10.4197	13.5342	17.7576	20.0572	22.0945	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.2876	-18.3911	-30.6846	-40.9024	-47.7264	-48.4294	-46.7805	-42.0238	-33.5784	-23.5555	-13.8560	-9.9059	(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	-3.2082	-6.7577	-15.7157	-28.9673	-40.9055	-47.0718	-44.4035	-35.7283	-22.8504	-10.9768	-4.2735	-2.3037	(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												1896.2163	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1748.4764	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.0240, total flow = 37.0000, SFP = 0.1358)													
mechanical ventilation fans (SFP = 0.1358)												30.9790	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.9790	(231)
Electricity for lighting (calculated in Appendix L)												173.4933	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-631.2840	(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												3303.8811	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1896.2163	6.1900	117.3758	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1748.4764	6.1900	108.2307	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	116.9790	25.1600	29.4319	(249)
Energy for lighting	173.4933	25.1600	43.6509	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	25.1600	-92.6194	
PV Unit electricity exported	-263.1624	5.8100	-15.2897	
Total			-107.9091	(252)
Total energy cost			292.7802	(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	1896.2163	0.2100	398.2054	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1748.4764	0.2100	367.1800	(264)
Space and water heating			765.3855	(265)
Pumps, fans and electric keep-hot	116.9790	0.1387	16.2264	(267)
Energy for lighting	173.4933	0.1443	25.0404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	0.1318	-48.5070	
PV Unit electricity exported	-263.1624	0.1215	-31.9737	
Total			-80.4807	(269)
Total CO2, kg/year			726.1717	(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	1896.2163	1.1300	2142.7245	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1748.4764	1.1300	1975.7784	(278)
Space and water heating			4118.5028	(279)
Pumps, fans and electric keep-hot	116.9790	1.5128	176.9659	(281)
Energy for lighting	173.4933	1.5338	266.1098	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	1.4868	-547.3312	
PV Unit electricity exported	-263.1624	0.4457	-117.2886	
Total			-664.6199	(283)
Total Primary energy kWh/year			3896.9586	(286)

SAP 10 EPC IMPROVEMENTS

1

Current energy efficiency rating: B 90
Current environmental impact rating: B 91

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

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 22	-130 kg (17.8%)

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

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£73	£73	£0
Mains gas	£328	£328	£0
Space heating	£249	£249	£0
Water heating	£108	£108	£0
Lighting	£44	£44	£0
Generated (PV)	-£108	-£108	£0
Total cost of fuels	£293	£293	£0
Total cost of uses	£293	£293	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes

CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000	(1b)	x 2.3100	(2b) =	88.7040	(1b) - (3b)
First floor	38.4000	(1c)	x 2.5600	(2c) =	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		187.0080	(5)

2. Ventilation rate

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

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

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16561.8398 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		215.6489 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.8500	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.8438 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.5571 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	(38)
Heat transfer coeff	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	(39)
Average = Sum(39)m / 12 =												79.4134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	(40)
HLP (average)												1.0340	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.3993 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018	(42a)

Hot water usage for baths

27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442	(42b)

Hot water usage for other uses

39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016	(42c)

Average daily hot water use (litres/day) 120.8679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5909	

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

31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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 5.4760	4.9364	5.4446	5.2250	5.3714	5.1700	5.3245	5.3392	5.1837	5.3888	5.2570	5.4702	(61)

Total heat required for water heating calculated for each month

213.7219	188.1766	197.9677	169.5849	161.3151	142.0281	137.8240	145.2087	148.9034	170.0146	185.6168	210.8157	(62)
WWHRS -57.3902	-50.7564	-53.1492	-44.0096	-41.0154	-35.0972	-32.8980	-34.9837	-36.3129	-42.8089	-48.4973	-56.3275	(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

156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
							Total per year (kWh/year) = Sum(64)m =				1537.9316	(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

70.6108	62.1615	65.3751	55.9559	53.1941	46.7978	45.3872	47.8414	49.0827	56.0853	61.2839	69.6449	(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	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.5598	21.8138	17.7402	13.4304	10.0394	8.4757	9.1583	11.9043	15.9779	20.2876	23.6786	25.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	317.3476	320.6407	312.3422	294.6758	272.3752	251.4157	237.4135	234.1204	242.4189	260.0853	282.3859	303.3454	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	(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)	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)	94.9069	92.5022	87.8698	77.7166	71.4975	64.9970	61.0043	64.3030	68.1705	75.3835	85.1165	93.6088	(72)
Total internal gains	539.5965	537.7389	520.7343	488.6050	456.6943	424.6706	407.3583	410.1099	426.3494	458.5385	493.9632	524.9787	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	19.6403	0.7300	0.7000	0.7700	22.4649	(76)
North	1.4000	10.6334	0.7300	0.7000	0.7700	5.2717	(74)
East	3.4500	19.6403	0.7300	0.7000	0.7700	23.9950	(76)
West	4.3700	19.6403	0.7300	0.7000	0.7700	30.3937	(80)

Solar gains 82.1253	160.4163	264.7106	388.5952	479.5804	492.6714	468.3131	399.8449	308.5419	190.3856	102.3307	67.5954	(83)
Total gains 621.7218	698.1552	785.4450	877.2002	936.2747	917.3420	875.6714	809.9547	734.8913	648.9242	596.2939	592.5741	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	
alpha	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	
util living area	0.9865	0.9753	0.9446	0.8649	0.7188	0.5396	0.3963	0.4458	0.6902	0.9123	0.9763	0.9892	(86)
MIT	19.8566	20.0415	20.3432	20.6756	20.8949	20.9787	20.9961	20.9932	20.9347	20.6249	20.1633	19.8003	(87)
Th 2	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	(88)

util rest of house													
	0.9829	0.9690	0.9307	0.8335	0.6640	0.4657	0.3126	0.3568	0.6144	0.8838	0.9691	0.9863	(89)
MIT 2	18.7378	18.9704	19.3441	19.7366	19.9691	20.0427	20.0537	20.0525	20.0111	19.6901	19.1270	18.6665	(90)
Living area fraction										fLA = Living area / (4) =		0.2861	(91)
MIT	19.0578	19.2768	19.6299	20.0052	20.2339	20.3104	20.3233	20.3216	20.2753	19.9575	19.4234	18.9909	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9078	19.1268	19.4799	19.8552	20.0839	20.1604	20.1733	20.1716	20.1253	19.8075	19.2734	18.8409	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9609	0.9203	0.8260	0.6658	0.4741	0.3231	0.3679	0.6204	0.8749	0.9611	0.9811	(94)
Useful gains	607.4501	670.8464	722.8687	724.5425	623.3897	434.9358	282.9654	298.0126	455.9389	567.7267	573.1238	581.3938	(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													
	1160.0582	1129.8005	1030.7766	869.9909	665.7964	441.5739	283.7672	299.5142	478.4873	731.2012	966.7345	1162.6815	(97)
Space heating kWh													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98a)
Space heating requirement - total per year (kWh/year)												1922.4173	
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													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1922.4173	
Space heating per m2											(98c) / (4) =	25.0315	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	411.1404	308.4172	229.0835	104.7229	31.5506	0.0000	0.0000	0.0000	0.0000	121.6250	283.3997	432.4781	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	461.9555	346.5361	257.3972	117.6662	35.4501	0.0000	0.0000	0.0000	0.0000	136.6573	318.4266	485.9305	(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													
	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.5251	88.4690	88.3338	88.0649	87.6478	87.3000	87.3000	87.3000	87.3000	88.1227	88.4384	88.5462	(217)
Fuel for water heating, kWh/month													
	176.5959	155.3315	163.9448	142.5940	137.2535	122.4868	120.1901	126.2600	128.9697	144.3507	155.0451	174.4719	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9352	8.9737	9.9352	9.6147	9.9352	9.6147	9.9352	9.9352	9.6147	9.9352	9.6147	9.9352	(231)
Lighting	21.4970	17.2457	15.5279	11.3764	8.7874	7.1794	8.0162	10.4197	13.5342	17.7576	20.0572	22.0945	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-10.2768	-17.1409	-29.5578	-39.0765	-46.7677	-45.3599	-44.4924	-39.3347	-31.0801	-21.5488	-12.0472	-8.5210	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-2.3925	-5.9940	-14.6995	-26.5602	-39.2810	-41.1428	-40.0725	-31.3423	-19.7627	-9.3884	-3.3842	-1.8028	(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												2160.0195	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1747.4941	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.0240, total flow = 37.0000, SFP = 0.1358)													
mechanical ventilation fans (SFP = 0.1358)												30.9790	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												116.9790	(231)
Electricity for lighting (calculated in Appendix L)												173.4933	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-581.0267	(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												3616.9592	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2160.0195	3.6400	78.6247	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1747.4941	3.6400	63.6088	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	116.9790	16.4900	19.2898	(249)
Energy for lighting	173.4933	16.4900	28.6090	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	16.4900	-56.9241	
PV Unit electricity exported	-235.8228	5.5900	-13.1825	
Total			-70.1066	(252)
Total energy cost			212.0258	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6267 (257)
SAP value		89.8416
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	2160.0195	0.2100	453.6041	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1747.4941	0.2100	366.9738	(264)
Space and water heating			820.5778	(265)
Pumps, fans and electric keep-hot	116.9790	0.1387	16.2264	(267)
Energy for lighting	173.4933	0.1443	25.0404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-345.2039	0.1316	-45.4191	
PV Unit electricity exported	-235.8228	0.1216	-28.6704	
Total			-74.0895	(269)
Total CO2, kg/year			787.7553	(272)
CO2 emissions per m2			10.2600	(273)
EI value			91.3334	
EI rating			91	(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 FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	38.4000 (1b)	x	2.3100 (2b)	=	88.7040	(1b) - (3b)
First floor	38.4000 (1c)	x	2.5600 (2c)	=	98.3040	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.8000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	187.0080	(5)

2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.1000	4.1000	3.9000	3.8000	3.2000	3.2000	3.2000	3.3000	3.8000	3.7000	3.9000	(22)
Wind factor	1.1500	1.0250	1.0250	0.9750	0.9500	0.8000	0.8000	0.8000	0.8250	0.9500	0.9250	0.9750	(22a)
Adj infilt rate													

	0.1955	0.1742	0.1742	0.1658	0.1615	0.1360	0.1360	0.1360	0.1403	0.1615	0.1573	0.1658 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 IG			2.2500	1.2000	2.7000			(26)
French doors - Eurcell Lo (Uw = 1.30)			3.2300	1.2357	3.9914			(27)
Window - Eurcell Logik (Uw = 1.30)			9.2200	1.2357	11.3935			(27)
B&B 225mm TE Platinum GF			38.4000	0.1000	3.8400	135.0000	5184.0000	(28a)
Full Fill Bead	85.7100	14.7000	71.0100	0.2300	16.3323	60.0000	4260.5999	(29a)
500mm Mineral Wool @ 0.044	38.4000		38.4000	0.0900	3.4560	10.0000	384.0000	(30)
Total net area of external elements Aum(A, m2)			162.5100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.7133			(33)
E-MW-22			38.9600	0.0000	0.0000	110.0000	4285.5999	(32)
63mm Timber			156.7600			9.0000	1410.8400	(32c)
FF Floor			38.4000			18.0000	691.2000	(32d)
GF Ceiling			38.4000			9.0000	345.6000	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	16561.8398 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		215.6489 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	5.4400	0.0260	0.1414
E3 Sill	7.9900	0.0310	0.2477
E4 Jamb	19.2000	0.0360	0.6912
E5 Ground floor (normal)	17.6000	0.0590	1.0384
E6 Intermediate floor within a dwelling	17.6000	0.0060	0.1056
E10 Eaves (insulation at ceiling level)	9.6000	0.1240	1.1904
E12 Gable (insulation at ceiling level)	8.0000	0.0570	0.4560
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0890	0.7120
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
E2 Other lintels (including other steel lintels)	5.1600	0.0400	0.2064
E4 Jamb	8.8500	0.0470	0.4159

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.8438 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	48.5571 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	30.8563	(38)
Heat transfer coeff	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	79.4134	(39)
Average = Sum(39)m / 12 =												79.4134	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	1.0340	(40)
HLP (average)												1.0340	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3993 (42)
Hot water usage for mixer showers	64.4487	63.4802	62.0688	59.3685	57.3757	55.1533	53.8901	55.2908	56.8262	59.2123	61.9707	64.2018 (42a)
Hot water usage for baths	27.8383	27.4249	26.8426	25.7692	24.9653	24.0740	23.5926	24.1707	24.8002	25.7540	26.8495	27.7442 (42b)
Hot water usage for other uses	39.2016	37.7761	36.3506	34.9251	33.4996	32.0741	32.0741	33.4996	34.9251	36.3506	37.7761	39.2016 (42c)
Average daily hot water use (litres/day)												120.8679 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	131.4887	128.6812	125.2621	120.0627	115.8406	111.3014	109.5568	112.9611	116.5515	121.3169	126.5964	131.1476	(44)
Energy conte	208.2459	183.2403	192.5232	164.3599	155.9437	136.8581	132.4995	139.8695	143.7197	164.6259	180.3597	205.3455	(45)
Energy content (annual)										Total = Sum(45)m =		2007.5909	
Distribution loss (46)m = 0.15 x (45)m	31.2369	27.4860	28.8785	24.6540	23.3916	20.5287	19.8749	20.9804	21.5580	24.6939	27.0540	30.8018	(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	5.4760	4.9364	5.4446	5.2250	5.3714	5.1700	5.3245	5.3392	5.1837	5.3888	5.2570	5.4702	(61)
Total heat required for water heating calculated for each month	213.7219	188.1766	197.9677	169.5849	161.3151	142.0281	137.8240	145.2087	148.9034	170.0146	185.6168	210.8157	(62)
WWHRS	-57.3902	-50.7564	-53.1492	-44.0096	-41.0154	-35.0972	-32.8980	-34.9837	-36.3129	-42.8089	-48.4973	-56.3275	(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	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
									Total per year (kWh/year) = Sum(64)m =			1537.9316	(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	70.6108	62.1615	65.3751	55.9559	53.1941	46.7978	45.3872	47.8414	49.0827	56.0853	61.2839	69.6449	(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	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	143.9604	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	24.5598	21.8138	17.7402	13.4304	10.0394	8.4757	9.1583	11.9043	15.9779	20.2876	23.6786	25.2424	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	317.3476	320.6407	312.3422	294.6758	272.3752	251.4157	237.4135	234.1204	242.4189	260.0853	282.3859	303.3454	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	51.7954	(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)													
	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	-95.9736	(71)
Water heating gains (Table 5)													
	94.9069	92.5022	87.8698	77.7166	71.4975	64.9970	61.0043	64.3030	68.1705	75.3835	85.1165	93.6088	(72)
Total internal gains													
	539.5965	537.7389	520.7343	488.6050	456.6943	424.6706	407.3583	410.1099	426.3494	458.5385	493.9632	524.9787	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	3.2300	23.8568	0.7300	0.7000	0.7700	27.2878	(76)
North	1.4000	12.8108	0.7300	0.7000	0.7700	6.3512	(74)
East	3.4500	23.8568	0.7300	0.7000	0.7700	29.1464	(76)
West	4.3700	23.8568	0.7300	0.7000	0.7700	36.9187	(80)

Solar gains	99.7041	173.1085	275.6657	411.3295	491.7282	541.7466	502.8251	437.5928	340.2751	210.9929	119.3336	79.3531	(83)
Total gains	639.3007	710.8473	796.4000	899.9346	948.4225	966.4172	910.1833	847.7026	766.6245	669.5314	613.2968	604.3319	(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	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	57.9312	
alpha	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	4.8621	
util living area													
	0.9825	0.9702	0.9316	0.8282	0.6602	0.4389	0.2961	0.3361	0.6051	0.8819	0.9689	0.9867	(86)
MIT	19.9568	20.1192	20.4322	20.7562	20.9343	20.9926	20.9992	20.9985	20.9671	20.7116	20.2590	19.8803	(87)
Th 2	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	20.0551	(88)
util rest of house													
	0.9778	0.9625	0.9143	0.7900	0.5989	0.3643	0.2141	0.2485	0.5219	0.8447	0.9592	0.9831	(89)
MIT 2	18.8647	19.0680	19.4526	19.8258	20.0056	20.0516	20.0549	20.0547	20.0360	19.7881	19.2465	18.7682	(90)
Living area fraction									fLA = Living area / (4) =			0.2861	(91)
MIT	19.1771	19.3687	19.7328	20.0919	20.2713	20.3208	20.3250	20.3247	20.3023	20.0522	19.5362	19.0863	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0271	19.2187	19.5828	19.9419	20.1213	20.1708	20.1750	20.1747	20.1523	19.9022	19.3862	18.9363	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9710	0.9537	0.9039	0.7849	0.6034	0.3736	0.2245	0.2597	0.5308	0.8376	0.9504	0.9773	(94)
Useful gains	620.7576	677.9490	719.8515	706.3789	572.2793	361.0346	204.3798	220.1133	406.9597	560.8286	582.8535	590.5984	(95)
Ext temp.	4.9000	5.4000	7.2000	9.7000	12.6000	15.6000	17.6000	17.4000	14.9000	11.3000	7.7000	4.7000	(96)
Heat loss rate W													
	1121.8802	1097.3895	983.3610	813.3479	597.2919	362.9800	204.4913	220.3464	417.1069	683.1336	928.0379	1130.5548	(97)
Space heating kWh													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98a)
Space heating requirement - total per year (kWh/year)												1687.6325	
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													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1687.6325	
Space heating per m2											(98c) / (4) =	21.9744	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	372.8352	281.8640	196.0511	77.0177	18.6094	0.0000	0.0000	0.0000	0.0000	90.9949	248.5328	401.7275	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	418.9160	316.7011	220.2822	86.5367	20.9094	0.0000	0.0000	0.0000	0.0000	102.2415	279.2503	451.3792	(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													
	156.3317	137.4202	144.8186	125.5753	120.2997	106.9310	104.9260	110.2250	112.5906	127.2058	137.1195	154.4882	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4909	88.4356	88.2697	87.9386	87.5240	87.3000	87.3000	87.3000	87.3000	88.0010	88.3880	88.5212	(217)
Fuel for water heating, kWh/month													

	176.6641	155.3902	164.0637	142.7989	137.4478	122.4868	120.1901	126.2600	128.9697	144.5504	155.1336	174.5211	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.9352	8.9737	9.9352	9.6147	9.9352	9.6147	9.9352	9.9352	9.6147	9.9352	9.6147	9.9352	(231)
Lighting	21.4970	17.2457	15.5279	11.3764	8.7874	7.1794	8.0162	10.4197	13.5342	17.7576	20.0572	22.0945	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-12.2876	-18.3911	-30.6846	-40.9024	-47.7264	-48.4294	-46.7805	-42.0238	-33.5784	-23.5555	-13.8560	-9.9059	(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	-3.2082	-6.7577	-15.7157	-28.9673	-40.9055	-47.0718	-44.4035	-35.7283	-22.8504	-10.9768	-4.2735	-2.3037	(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	1896.2163	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1748.4764	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.0240, total flow = 37.0000, SFP = 0.1358)		
mechanical ventilation fans (SFP = 0.1358)	30.9790	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	116.9790	(231)
Electricity for lighting (calculated in Appendix L)	173.4933	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-631.2840	(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	3303.8811	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1896.2163	6.1900	117.3758	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1748.4764	6.1900	108.2307	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	116.9790	25.1600	29.4319	(249)
Energy for lighting	173.4933	25.1600	43.6509	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	25.1600	-92.6194	
PV Unit electricity exported	-263.1624	5.8100	-15.2897	
Total			-107.9091	(252)
Total energy cost			292.7802	(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	1896.2163	0.2100	398.2054	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1748.4764	0.2100	367.1800	(264)
Space and water heating			765.3855	(265)
Pumps, fans and electric keep-hot	116.9790	0.1387	16.2264	(267)
Energy for lighting	173.4933	0.1443	25.0404	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	0.1318	-48.5070	
PV Unit electricity exported	-263.1624	0.1215	-31.9737	
Total			-80.4807	(269)
Total CO2, kg/year			726.1717	(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	1896.2163	1.1300	2142.7245	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1748.4764	1.1300	1975.7784	(278)
Space and water heating			4118.5028	(279)
Pumps, fans and electric keep-hot	116.9790	1.5128	176.9659	(281)
Energy for lighting	173.4933	1.5338	266.1098	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-368.1216	1.4868	-547.3312	
PV Unit electricity exported	-263.1624	0.4457	-117.2886	
Total			-664.6199	(283)
Total Primary energy kWh/year			3896.9586	(286)

Full SAP Calculation Printout

Property Reference	Plot 120 H442 09PE Det	**Issued on Date**	18/03/2024
Assessment Reference	1	**Prop Type Ref**	1
Property	Plot 120, The Pavilions, Bodicote, OX15		

SAP Rating	92 A	**DER**	9.62	**TER**	10.12
Environmental	91 B	**% DER < TER**			4.94
CO_2 Emissions (t/year)	1.16	**DFEE**	37.97	**TFEE**	38.83
Compliance Check	See BREL	**% DFEE < TFEE**			2.23
% DPER < TPER	3.79	**DPER**	50.93	**TPER**	52.94

Assessor Details	Ms. Alina Spataru	**Assessor ID**	BD89-0001
Client	BDW Mercia, BDW Mercia		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800 (1b)	x	2.3100 (2b)	=	145.9458	(1b) - (3b)
First floor	62.6500 (1c)	x	2.5600 (2c)	=	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3298	(5)

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2. Ventilation rate

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			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0326	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2326	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1977	(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	0.2521	0.2472	0.2422	0.2175	0.2126	0.1879	0.1879	0.1829	0.1977	0.2126	0.2225	0.2324	(22b)

Mechanical extract ventilation - decentralised

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

Effective ac	0.5021	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 25097.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 199.4528 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705
E3 Sill	12.2700	0.0310	0.3804
E4 Jamb	29.2500	0.0360	1.0530
E5 Ground floor (normal)	32.0700	0.0590	1.8921
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684
E16 Corner (normal)	19.4800	0.0520	1.0130
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957
E14 Flat roof	2.0700	0.0390	0.0807
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	8.8500	0.0470	0.4159
E16 Corner (normal)	1.5000	0.0290	0.0435
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1177 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.1490 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7596	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	(38)

Heat transfer coeff

	128.9086	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	(39)

Average = Sum(39)m / 12 = 128.7114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	(40)
HLP (average)												1.0229	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8833 (42)
Hot water usage for mixer showers

72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)

Hot water usage for baths

31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)

Hot water usage for other uses

44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)

Average daily hot water use (litres/day) 136.0901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)
Energy content (annual)										Total = Sum(45)m =		2260.4288	
Distribution loss (46)m = 0.15 x (45)m													
	35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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	5.5285	4.9825	5.4930	5.2664	5.4107	5.2045	5.3579	5.3745	5.2199	5.4302	5.3024	5.5219	(61)
Total heat required for water heating calculated for each month													
	240.0016	211.3002	222.2622	190.3255	180.9935	159.2979	154.5442	162.8593	167.0402	190.7898	208.3773	236.7295	(62)
WWHRS	-64.6160	-57.1469	-59.8410	-49.5507	-46.1795	-39.5161	-37.0400	-39.3884	-40.8849	-48.1988	-54.6034	-63.4194	(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													
	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
										Total per year (kWh/year) = Sum(64)m =		1724.1363	(64)
12Total per year (kWh/year)												1724	(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													
	79.3444	69.8462	73.4490	62.8488	59.7339	52.5372	50.9439	53.7073	55.1102	62.9896	68.8480	78.2570	(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	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	159.3944	176.4724	159.3944	164.7075	159.3944	164.7075	159.3944	159.3944	164.7075	159.3944	164.7075	159.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	292.6210	295.6575	288.0057	271.7158	251.1527	231.8263	218.9151	215.8786	223.5304	239.8203	260.3834	279.7098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	(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)													
	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)													
	106.6458	103.9379	98.7218	87.2899	80.2876	72.9683	68.4730	72.1873	76.5420	84.6635	95.6222	105.1841	(72)
Total internal gains													
	627.9106	645.3172	615.3713	592.9627	560.0841	535.7516	513.0319	513.7097	531.0294	553.1276	589.9626	613.5378	(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	5.0400	10.6334	0.7300	0.7000	0.7700	18.9783	(74)

North				4.3500	10.6334	0.7300	0.7000	0.7700				16.3800	(74)
East				0.7200	19.6403	0.7300	0.7000	0.7700				5.0076	(76)
South				6.2600	46.7521	0.7300	0.7000	0.7700				103.6404	(78)
West				0.7200	19.6403	0.7300	0.7000	0.7700				5.0076	(80)
Solar gains	149.0141	256.8999	363.2999	475.8571	560.7633	570.0677	543.9620	477.8168	401.4385	286.7593	178.9562	127.2674	(83)
Total gains	776.9247	902.2171	978.6712	1068.8197	1120.8474	1105.8193	1056.9939	991.5265	932.4679	839.8869	768.9188	740.8052	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0804	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	
alpha	4.6054	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	
util living area	0.9941	0.9877	0.9751	0.9371	0.8476	0.6844	0.5213	0.5734	0.8011	0.9531	0.9883	0.9953	(86)
MIT	19.5611	19.7686	20.0492	20.4206	20.7427	20.9303	20.9841	20.9756	20.8530	20.4391	19.9271	19.5143	(87)
Th 2	20.0630	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	(88)
util rest of house	0.9926	0.9845	0.9683	0.9192	0.8048	0.6048	0.4172	0.4674	0.7339	0.9361	0.9847	0.9940	(89)
MIT 2	18.3766	18.6416	18.9966	19.4565	19.8311	20.0183	20.0579	20.0535	19.9530	19.4867	18.8450	18.3179	(90)
Living area fraction									fLA = Living area / (4) =			0.1482	(91)
MIT	18.5522	18.8086	19.1526	19.5994	19.9662	20.1535	20.1952	20.1902	20.0864	19.6279	19.0054	18.4952	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4022	18.6586	19.0026	19.4494	19.8162	20.0035	20.0452	20.0402	19.9364	19.4779	18.8554	18.3452	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9885	0.9776	0.9578	0.9044	0.7916	0.5992	0.4150	0.4645	0.7233	0.9220	0.9778	0.9906	(94)
Useful gains	767.9768	882.0058	937.4152	966.6709	887.2986	662.5658	438.6530	460.5612	674.4462	774.4167	751.8534	733.8063	(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	1817.8898	1770.6460	1609.0090	1357.6361	1044.4983	695.3913	443.3741	468.4652	751.1044	1142.5237	1512.8430	1820.3993	(97)
Space heating kWh	781.1352	597.1662	499.6658	281.4949	116.9566	0.0000	0.0000	0.0000	0.0000	273.8716	547.9125	808.4252	(98a)
Space heating requirement - total per year (kWh/year)												3906.6281	
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	781.1352	597.1662	499.6658	281.4949	116.9566	0.0000	0.0000	0.0000	0.0000	273.8716	547.9125	808.4252	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3906.6281	
Space heating per m2											(98c) / (4) =	31.0469	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	781.1352	597.1662	499.6658	281.4949	116.9566	0.0000	0.0000	0.0000	0.0000	273.8716	547.9125	808.4252	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	877.6801	670.9733	561.4222	316.2864	131.4119	0.0000	0.0000	0.0000	0.0000	307.7209	615.6320	908.3429	(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	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6834	88.6458	88.5769	88.4260	88.0816	87.3000	87.3000	87.3000	87.3000	88.4105	88.6218	88.6951	(217)
Fuel for water heating, kWh/month	197.7661	173.8979	183.3676	159.2008	153.0559	137.2072	134.5981	141.4330	144.5079	161.2828	173.5171	195.3998	(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	11.0876	10.0146	11.0876	10.7299	11.0876	10.7299	11.0876	11.0876	10.7299	11.0876	10.7299	11.0876	(231)
Lighting	33.3074	26.7204	24.0588	17.6265	13.6152	11.1237	12.4202	16.1443	20.9699	27.5136	31.0765	34.2331	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-31.8419	-45.6323	-66.2758	-75.8428	-83.4934	-78.5753	-77.7789	-72.7502	-64.3428	-52.9826	-35.3907	-27.5129	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.9288	-26.5340	-50.5977	-73.2170	-94.9513	-94.7403	-94.1280	-81.0850	-61.4591	-37.5623	-17.1949	-10.3122	(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												4389.4697	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	

Water heating fuel used	1955.2341	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3640, total flow = 45.0000, SFP = 0.1192)		
mechanical ventilation fans (SFP = 0.1192)	44.5477	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	130.5477	(231)
Electricity for lighting (calculated in Appendix L)	268.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1367.1302	(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	5376.9309	(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	4389.4697	0.2100	921.7886	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.2341	0.2100	410.5992	(264)
Space and water heating			1332.3878	(265)
Pumps, fans and electric keep-hot	130.5477	0.1387	18.1086	(267)
Energy for lighting	268.8095	0.1443	38.7975	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	0.1342	-95.5928	
PV Unit electricity exported	-654.7105	0.1268	-83.0057	
Total			-178.5985	(269)
Total CO2, kg/year			1210.6954	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.6200	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	4389.4697	1.1300	4960.1008	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.2341	1.1300	2209.4145	(278)
Space and water heating			7169.5153	(279)
Pumps, fans and electric keep-hot	130.5477	1.5128	197.4926	(281)
Energy for lighting	268.8095	1.5338	412.3090	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	1.4959	-1065.6970	
PV Unit electricity exported	-654.7105	0.4654	-304.7123	
Total			-1370.4093	(283)
Total Primary energy kWh/year			6408.9076	(286)
Dwelling Primary energy Rate (DPER)			50.9300	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800 (1b)	x	2.3100 (2b)	=	145.9458	(1b) - (3b)
First floor	62.6500 (1c)	x	2.5600 (2c)	=	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 125.8300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3298	(5)

2. Ventilation rate

	m3 per hour			
Number of open chimneys	0 * 80 =	0.0000	(6a)	
Number of open flues	0 * 20 =	0.0000	(6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)	
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)	
Number of blocked chimneys	0 * 20 =	0.0000	(6f)	
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)	
Number of passive vents	0 * 10 =	0.0000	(7b)	
Number of flueless gas fires	0 * 40 =	0.0000	(7c)	
	Air changes per hour			
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1306	(8)	
Pressure test		Yes		
Pressure Test Method		Blower Door		
Measured/design AP50		5.0000	(17)	
Infiltration rate		0.3806	(18)	
Number of sides sheltered		2	(19)	

Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3235 (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	0.4125	0.4044	0.3963	0.3558	0.3478	0.3073	0.3073	0.2992	0.3235	0.3478	0.3639	0.3801	(22b)
Effective ac	0.5851	0.5818	0.5785	0.5633	0.5605	0.5472	0.5472	0.5448	0.5523	0.5605	0.5662	0.5722	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.3700	1.0000	2.3700			(26)
TER Semi-glazed door			2.0000	1.0000	2.0000			(26a)
TER Opening Type (Uw = 1.20)			17.0900	1.1450	19.5687			(27)
B&B 225mm TE Platinum GF			63.1800	0.1300	8.2134			(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.1800	24.0966			(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.1100	6.8915			(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1100	0.0583			(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		63.1985			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.4528 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	14.2500	0.0500	0.7125
E3	Sill	12.2700	0.0500	0.6135
E4	Jamb	29.2500	0.0500	1.4625
E5	Ground floor (normal)	32.0700	0.1600	5.1312
E6	Intermediate floor within a dwelling	31.7400	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	14.7500	0.0600	0.8850
E12	Gable (insulation at ceiling level)	16.9900	0.0600	1.0194
E16	Corner (normal)	19.4800	0.0900	1.7532
E24	Eaves (insulation at ceiling level - inverted)	1.7400	0.2400	0.4176
E14	Flat roof	2.0700	0.0800	0.1656
E4	Jamb	3.0000	0.0500	0.1500
E4	Jamb	8.8500	0.0500	0.4425
E16	Corner (normal)	1.5000	0.0900	0.1350
E17	Corner (inverted - internal area greater than external area)	1.5000	-0.0900	-0.1350

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		12.7530 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	75.9515 (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	59.1428	58.8090	58.4817	56.9445	56.6569	55.3180	55.3180	55.0701	55.8337	56.6569	57.2387	57.8470	(38)
Heat transfer coeff	135.0944	134.7605	134.4332	132.8960	132.6084	131.2695	131.2695	131.0216	131.7852	132.6084	133.1902	133.7985	(39)
Average = Sum(39)m / 12 =												132.8946	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0710	1.0684	1.0562	1.0539	1.0432	1.0432	1.0413	1.0473	1.0539	1.0585	1.0633	(40)
HLP (average)												1.0561	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8833 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)
Hot water usage for baths	31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)
Hot water usage for other uses	44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)
Average daily hot water use (litres/day)												136.0901	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)
Energy content (annual)										Total = Sum(45)m =		2260.4288	
Distribution loss (46)m = 0.15 x (45)m	35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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	285.4321	252.3451	267.7281	234.3742	226.5417	203.4085	200.1452	208.4438	211.1354	236.3185	252.3900	282.1665	(62)
WWHRS	-33.1729	-29.3384	-30.7214	-25.4386	-23.7078	-20.2870	-19.0158	-20.2214	-20.9897	-24.7445	-28.0325	-32.5586	(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	252.2592	223.0067	237.0067	208.9356	202.8339	183.1216	181.1294	188.2224	190.1457	211.5739	224.3574	249.6079	(64)
									Total per year (kWh/year) = Sum(64)m =			2552.2004	(64)
12Total per year (kWh/year)												2552	(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	90.7021	80.1075	84.8155	73.8609	71.1210	63.5648	62.3442	65.1034	66.1340	74.3718	79.8512	89.6162	(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	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	159.3944	176.4724	159.3944	164.7075	159.3944	164.7075	159.3944	159.3944	164.7075	159.3944	164.7075	159.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	292.6210	295.6575	288.0057	271.7158	251.1527	231.8263	218.9151	215.8786	223.5304	239.8203	260.3834	279.7098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	(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)													
	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)													
	121.9114	119.2075	113.9993	102.5846	95.5927	88.2845	83.7959	87.5046	91.8528	99.9621	110.9044	120.4519	(72)
Total internal gains													
	643.1762	660.5869	630.6488	608.2573	575.3893	551.0678	528.3548	529.0270	546.3402	568.4262	605.2448	628.8056	(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	9.3900	10.6334	0.6300	0.7000	0.7700	30.5147	(74)
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(76)
South	6.2600	46.7521	0.6300	0.7000	0.7700	89.4431	(78)
West	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(80)

Solar gains	128.6012	221.7082	313.5328	410.6712	483.9465	491.9763	469.4466	412.3624	346.4469	247.4772	154.4417	109.8335	(83)
Total gains	771.7774	882.2950	944.1816	1018.9285	1059.3357	1043.0440	997.8015	941.3895	892.7871	815.9034	759.6865	738.6391	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6041	51.7320	51.8579	52.4578	52.5715	53.1077	53.1077	53.2082	52.8999	52.5715	52.3419	52.1039	
alpha	4.4403	4.4488	4.4572	4.4972	4.5048	4.5405	4.5405	4.5472	4.5267	4.5048	4.4895	4.4736	
util living area													
	0.9944	0.9891	0.9792	0.9488	0.8746	0.7214	0.5575	0.6071	0.8265	0.9594	0.9891	0.9954	(86)
MIT	19.4651	19.6619	19.9422	20.3362	20.6823	20.9090	20.9778	20.9676	20.8222	20.3824	19.8621	19.4369	(87)
Th 2	20.0224	20.0246	20.0267	20.0368	20.0387	20.0475	20.0475	20.0491	20.0441	20.0387	20.0349	20.0309	(88)
util rest of house													
	0.9929	0.9862	0.9734	0.9333	0.8354	0.6413	0.4466	0.4961	0.7618	0.9440	0.9857	0.9941	(89)
MIT 2	18.2261	18.4783	18.8354	19.3341	19.7453	19.9859	20.0383	20.0344	19.9067	19.3990	18.7419	18.1958	(90)
Living area fraction									fLA = Living area / (4) =			0.1482	(91)
MIT	18.4097	18.6537	18.9994	19.4826	19.8842	20.1227	20.1775	20.1727	20.0424	19.5447	18.9080	18.3798	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4097	18.6537	18.9994	19.4826	19.8842	20.1227	20.1775	20.1727	20.0424	19.5447	18.9080	18.3798	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9804	0.9649	0.9221	0.8281	0.6482	0.4624	0.5114	0.7616	0.9337	0.9799	0.9910	(94)
Useful gains	763.4263	864.9791	911.0751	939.5350	877.2386	676.0651	461.3757	481.3969	679.9870	761.8040	744.4306	731.9717	(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													
	1906.1428	1853.4543	1680.3402	1406.3895	1085.2935	724.9671	469.6191	494.3023	783.1191	1186.1475	1572.7036	1897.2322	(97)
Space heating kWh													
	850.1811	664.2554	572.3332	336.1353	154.7928	0.0000	0.0000	0.0000	0.0000	315.7116	596.3565	866.9538	(98a)
Space heating requirement - total per year (kWh/year)												4356.7197	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	850.1811	664.2554	572.3332	336.1353	154.7928	0.0000	0.0000	0.0000	0.0000	315.7116	596.3565	866.9538	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4356.7197	
Space heating per m2											(98c) / (4) =	34.6239	(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													
	850.1811	664.2554	572.3332	336.1353	154.7928	0.0000	0.0000	0.0000	0.0000	315.7116	596.3565	866.9538	(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)													
	920.1094	718.8911	619.4082	363.7828	167.5247	0.0000	0.0000	0.0000	0.0000	341.6792	645.4075	938.2617	(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													
	252.2592	223.0067	237.0067	208.9356	202.8339	183.1216	181.1294	188.2224	190.1457	211.5739	224.3574	249.6079	(64)
Efficiency of water heater												80.3000	(216)

(217)m	86.7735	86.5697	86.1966	85.3943	83.8092	80.3000	80.3000	80.3000	80.3000	85.2371	86.3713	86.8213 (217)
Fuel for water heating, kWh/month												
	290.7099	257.6037	274.9604	244.6715	242.0186	228.0468	225.5659	234.3990	236.7941	248.2182	259.7593	287.4960 (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	33.1190	26.5693	23.9227	17.5268	13.5382	11.0608	12.3500	16.0530	20.8513	27.3580	30.9008	34.0395 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-56.3129	-77.9839	-110.0898	-121.4352	-128.9223	-119.5260	-117.9638	-112.3067	-102.0870	-87.9949	-61.3752	-48.8453 (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	-36.1951	-75.6095	-149.3519	-223.0240	-293.7105	-294.7663	-291.3723	-247.3000	-182.0072	-107.7794	-48.2014	-28.6690 (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	4715.0646 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	80.3000
Water heating fuel used	3030.2435 (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)	267.2894 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-3122.8298 (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	4975.7676 (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	4715.0646	0.2100	990.1636	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3030.2435	0.2100	636.3511	(264)
Space and water heating			1626.5147	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	267.2894	0.1443	38.5781	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1144.8432	0.1350	-154.5500	
PV Unit electricity exported	-1977.9866	0.1261	-249.3465	
Total			-403.8965	(269)
Total CO2, kg/year			1273.1256	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1200	(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	4715.0646	1.1300	5328.0230	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3030.2435	1.1300	3424.1751	(278)
Space and water heating			8752.1981	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	267.2894	1.5338	409.9773	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1144.8432	1.4989	-1716.0601	
PV Unit electricity exported	-1977.9866	0.4627	-915.2868	
Total			-2631.3470	(283)
Total Primary energy kWh/year			6660.9293	(286)
Target Primary Energy Rate (TPER)			52.9400	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800 (1b)	x	2.3100 (2b)	=	145.9458	(1b) - (3b)
First floor	62.6500 (1c)	x	2.5600 (2c)	=	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 125.8300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	306.3298	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1306	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3306	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2810	(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	0.3583	0.3512	0.3442	0.3091	0.3021	0.2669	0.2669	0.2599	0.2810	0.3021	0.3161	0.3302	(22b)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5642	0.5617	0.5592	0.5478	0.5456	0.5356	0.5356	0.5338	0.5395	0.5456	0.5500	0.5545	(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	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 25097.1400	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	199.4528	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705
E3 Sill	12.2700	0.0310	0.3804
E4 Jamb	29.2500	0.0360	1.0530
E5 Ground floor (normal)	32.0700	0.0590	1.8921
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684
E16 Corner (normal)	19.4800	0.0520	1.0130
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957
E14 Flat roof	2.0700	0.0390	0.0807
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	8.8500	0.0470	0.4159
E16 Corner (normal)	1.5000	0.0290	0.0435
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.1177	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	78.1490	(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	57.0320	56.7800	56.5331	55.3733	55.1563	54.1461	54.1461	53.9590	54.5352	55.1563	55.5953	56.0542	(38)
Heat transfer coeff	135.1810	134.9291	134.6821	133.5223	133.3053	132.2951	132.2951	132.1081	132.6842	133.3053	133.7443	134.2032	(39)
Average = Sum(39)m / 12 =												133.5213	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0743	1.0723	1.0703	1.0611	1.0594	1.0514	1.0514	1.0499	1.0545	1.0594	1.0629	1.0665	(40)
HLP (average)												1.0611	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8833	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42a)
Hot water usage for baths	31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)
Hot water usage for other uses	44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)
Average daily hot water use (litres/day)												69.1893	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

	75.4856	73.4146	71.1537	68.3399	65.8296	63.2208	62.6790	64.9354	67.2495	69.9285	72.7672	75.3797	(44)
Energy conte	119.5508	104.5414	109.3606	93.5539	88.6193	77.7374	75.8049	80.4036	82.9254	94.8923	103.6702	118.0264	(45)
Energy content (annual)											Total = Sum(45)m =	1149.0861	
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													
	101.6181	88.8602	92.9565	79.5208	75.3264	66.0768	64.4341	68.3430	70.4866	80.6585	88.1197	100.3224	(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													
	101.6181	88.8602	92.9565	79.5208	75.3264	66.0768	64.4341	68.3430	70.4866	80.6585	88.1197	100.3224	(64)
										Total per year (kWh/year) = Sum(64)m =		976.7232	(64)
12Total per year (kWh/year)												977	(64)
Electric shower(s)													
	58.1110	51.7774	56.5390	53.9544	54.9669	52.4331	54.1808	54.9669	53.9544	56.5390	55.4758	58.1110	(64a)
							Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =					661.0098	(64a)
Heat gains from water heating, kWh/month													
	39.9323	35.1594	37.3739	33.3688	32.5733	29.6275	29.6537	30.8275	31.1103	34.2994	35.8989	39.6084	(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	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	159.3944	176.4724	159.3944	164.7075	159.3944	164.7075	159.3944	159.3944	164.7075	159.3944	164.7075	159.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	292.6210	295.6575	288.0057	271.7158	251.1527	231.8263	218.9151	215.8786	223.5304	239.8203	260.3834	279.7098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	(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)													
	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)													
	53.6724	52.3205	50.2337	46.3456	43.7813	41.1493	39.8572	41.4348	43.2087	46.1013	49.8595	53.2371	(72)
Total internal gains													
	571.9373	590.6999	563.8832	549.0183	520.5779	503.9325	484.4161	482.9572	497.6961	511.5655	541.1999	558.5907	(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	5.0400	10.6334	0.7300	0.7000	0.7700	18.9783	(74)
North	4.3500	10.6334	0.7300	0.7000	0.7700	16.3800	(74)
East	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(76)
South	6.2600	46.7521	0.7300	0.7000	0.7700	103.6404	(78)
West	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(80)

Solar gains	149.0141	256.8999	363.2999	475.8571	560.7633	570.0677	543.9620	477.8168	401.4385	286.7593	178.9562	127.2674	(83)
Total gains	720.9514	847.5998	927.1830	1024.8754	1081.3412	1074.0003	1028.3780	960.7740	899.1346	798.3248	720.1561	685.8581	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.5711	51.6674	51.7621	52.2117	52.2967	52.6960	52.6960	52.7706	52.5415	52.2967	52.1250	51.9468	
alpha	4.4381	4.4445	4.4508	4.4808	4.4864	4.5131	4.5131	4.5180	4.5028	4.4864	4.4750	4.4631	
util living area													
	0.9957	0.9906	0.9806	0.9481	0.8689	0.7103	0.5464	0.6006	0.8256	0.9625	0.9912	0.9966	(86)
MIT	19.4127	19.6255	19.9231	20.3343	20.6895	20.9131	20.9790	20.9682	20.8207	20.3608	19.8164	19.3775	(87)
Th 2	20.0219	20.0235	20.0251	20.0327	20.0341	20.0407	20.0407	20.0420	20.0382	20.0341	20.0312	20.0282	(88)
util rest of house													
	0.9945	0.9881	0.9751	0.9325	0.8286	0.6294	0.4363	0.4895	0.7605	0.9482	0.9883	0.9956	(89)
MIT 2	18.5700	18.7827	19.0784	19.4840	19.8118	19.9953	20.0340	20.0308	19.9304	19.5163	18.9794	18.5398	(90)
Living area fraction										fLA = Living area / (4) =		0.1482	(91)
MIT	18.6949	18.9076	19.2036	19.6100	19.9419	20.1314	20.1741	20.1697	20.0623	19.6415	19.1035	18.6640	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6949	18.9076	19.2036	19.6100	19.9419	20.1314	20.1741	20.1697	20.0623	19.6415	19.1035	18.6640	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9842	0.9689	0.9241	0.8242	0.6377	0.4522	0.5052	0.7624	0.9406	0.9846	0.9938	(94)
Useful gains	715.3912	834.1908	898.3719	947.0742	891.2172	684.8363	465.0644	485.3539	685.4596	750.9184	709.0303	681.5738	(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													
	1945.9234	1890.0356	1710.9481	1430.0223	1098.6847	731.7711	472.8339	498.0107	791.1061	1205.2741	1605.3950	1941.1120	(97)
Space heating kWh													
	915.5159	709.5278	604.5567	347.7226	154.3558	0.0000	0.0000	0.0000	0.0000	338.0407	645.3826	937.0965	(98a)
Space heating requirement - total per year (kWh/year)												4652.1986	
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													

	915.5159	709.5278	604.5567	347.7226	154.3558	0.0000	0.0000	0.0000	338.0407	645.3826	937.0965	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4652.1986	
Space heating per m2										(98c) / (4) =	36.9721	(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	1243.5743	978.9840	1004.0214	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7966	0.8721	0.8383	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	990.6262	853.7879	841.6585	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1180.2669	1130.3143	1054.5658	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	136.5413	205.7357	158.4030	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	34.1353	51.4339	39.6007	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												125.1700	(107)
Energy for space heating												36.9721	(99)
Energy for space cooling												0.9948	(108)
Total												37.9668	(109)
Fabric Energy Efficiency (DFEE)												38.0	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800	(1b)	x 2.3100	(2b) =	145.9458	(1b) - (3b)
First floor	62.6500	(1c)	x 2.5600	(2c) =	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		306.3298	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1306	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3806	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3235	(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													
	0.4125	0.4044	0.3963	0.3558	0.3478	0.3073	0.3073	0.2992	0.3235	0.3478	0.3639	0.3801	(22b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.0000	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												0.0000	(23c)
Effective ac	0.5851	0.5818	0.5785	0.5633	0.5605	0.5472	0.5472	0.5448	0.5523	0.5605	0.5662	0.5722	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.3700	1.0000	2.3700			(26)
TER Semi-glazed door			2.0000	1.0000	2.0000			(26a)
TER Opening Type (Uw = 1.20)			17.0900	1.1450	19.5687			(27)
B&B 225mm TE Platinum GF			63.1800	0.1300	8.2134			(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.1800	24.0966			(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.1100	6.8915			(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1100	0.0583			(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.1985			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							199.4528	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	14.2500	0.0500	0.7125
E3	Sill	12.2700	0.0500	0.6135
E4	Jamb	29.2500	0.0500	1.4625
E5	Ground floor (normal)	32.0700	0.1600	5.1312
E6	Intermediate floor within a dwelling	31.7400	0.0000	0.0000
E10	Eaves (insulation at ceiling level)	14.7500	0.0600	0.8850
E12	Gable (insulation at ceiling level)	16.9900	0.0600	1.0194
E16	Corner (normal)	19.4800	0.0900	1.7532
E24	Eaves (insulation at ceiling level - inverted)	1.7400	0.2400	0.4176
E14	Flat roof	2.0700	0.0800	0.1656
E4	Jamb	3.0000	0.0500	0.1500
E4	Jamb	8.8500	0.0500	0.4425
E16	Corner (normal)	1.5000	0.0900	0.1350
E17	Corner (inverted - internal area greater than external area)	1.5000	-0.0900	-0.1350

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 12.7530 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 75.9515 (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	59.1428	58.8090	58.4817	56.9445	56.6569	55.3180	55.3180	55.0701	55.8337	56.6569	57.2387	57.8470	(38)
Heat transfer coeff	135.0944	134.7605	134.4332	132.8960	132.6084	131.2695	131.2695	131.0216	131.7852	132.6084	133.1902	133.7985	(39)

Average = Sum(39)m / 12 = 132.8946

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0736	1.0710	1.0684	1.0562	1.0539	1.0432	1.0432	1.0413	1.0473	1.0539	1.0585	1.0633	(40)
HLP (average)												1.0561	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8833 (42)

Hot water usage for mixer showers

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

Hot water usage for baths

31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)

Hot water usage for other uses

44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)

Average daily hot water use (litres/day) 69.1893 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	75.4856	73.4146	71.1537	68.3399	65.8296	63.2208	62.6790	64.9354	67.2495	69.9285	72.7672	75.3797	(44)
Energy conte	119.5508	104.5414	109.3606	93.5539	88.6193	77.7374	75.8049	80.4036	82.9254	94.8923	103.6702	118.0264	(45)
Energy content (annual)										Total = Sum(45)m =		1149.0861	
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	101.6181	88.8602	92.9565	79.5208	75.3264	66.0768	64.4341	68.3430	70.4866	80.6585	88.1197	100.3224	(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	101.6181	88.8602	92.9565	79.5208	75.3264	66.0768	64.4341	68.3430	70.4866	80.6585	88.1197	100.3224	(64)
									Total per year (kWh/year) = Sum(64)m =			976.7232	(64)
12Total per year (kWh/year)												977	(64)
Electric shower(s)	58.1110	51.7774	56.5390	53.9544	54.9669	52.4331	54.1808	54.9669	53.9544	56.5390	55.4758	58.1110	(64a)
					Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =							661.0098	(64a)
Heat gains from water heating, kWh/month	39.9323	35.1594	37.3739	33.3688	32.5733	29.6275	29.6537	30.8275	31.1103	34.2994	35.8989	39.6084	(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	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	144.1648	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.3944	176.4724	159.3944	164.7075	159.3944	164.7075	159.3944	159.3944	164.7075	159.3944	164.7075	159.3944	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	292.6210	295.6575	288.0057	271.7158	251.1527	231.8263	218.9151	215.8786	223.5304	239.8203	260.3834	279.7098	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	37.4165	(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)	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)	53.6724	52.3205	50.2337	46.3456	43.7813	41.1493	39.8572	41.4348	43.2087	46.1013	49.8595	53.2371	(72)
Total internal gains	571.9373	590.6999	563.8832	549.0183	520.5779	503.9325	484.4161	482.9572	497.6961	511.5655	541.1999	558.5907	(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	9.3900	10.6334	0.6300	0.7000	0.7700	30.5147	(74)
East	0.7200	19.6403	0.6300	0.7000	0.7700	4.3217	(76)
South	6.2600	46.7521	0.6300	0.7000	0.7700	89.4431	(78)

West			0.7200		19.6403		0.6300		0.7000		0.7700		4.3217 (80)
Solar gains	128.6012	221.7082	313.5328	410.6712	483.9465	491.9763	469.4466	412.3624	346.4469	247.4772	154.4417	109.8335	(83)
Total gains	700.5385	812.4080	877.4159	959.6895	1004.5243	995.9088	953.8627	895.3196	844.1430	759.0427	695.6416	668.4242	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6041	51.7320	51.8579	52.4578	52.5715	53.1077	53.1077	53.2082	52.8999	52.5715	52.3419	52.1039	
alpha	4.4403	4.4488	4.4572	4.4972	4.5048	4.5405	4.5405	4.5472	4.5267	4.5048	4.4895	4.4736	
util living area	0.9962	0.9920	0.9841	0.9580	0.8912	0.7437	0.5794	0.6322	0.8481	0.9683	0.9923	0.9969	(86)
MIT	19.3934	19.5931	19.8792	20.2872	20.6500	20.8968	20.9742	20.9619	20.7995	20.3329	19.7988	19.3657	(87)
Th 2	20.0224	20.0246	20.0267	20.0368	20.0387	20.0475	20.0475	20.0491	20.0441	20.0387	20.0349	20.0309	(88)
util rest of house	0.9951	0.9899	0.9795	0.9448	0.8553	0.6645	0.4659	0.5192	0.7872	0.9558	0.9898	0.9961	(89)
MIT 2	18.5512	18.7515	19.0368	19.4434	19.7833	19.9921	20.0390	20.0353	19.9208	19.4938	18.9649	18.5300	(90)
Living area fraction										fLA = Living area / (4) =		0.1482	(91)
MIT	18.6760	18.8763	19.1617	19.5684	19.9118	20.1262	20.1776	20.1727	20.0510	19.6182	19.0885	18.6539	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6760	18.8763	19.1617	19.5684	19.9118	20.1262	20.1776	20.1727	20.0510	19.6182	19.0885	18.6539	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9931	0.9864	0.9740	0.9367	0.8497	0.6717	0.4821	0.5349	0.7877	0.9487	0.9863	0.9943	(94)
Useful gains	695.6803	801.3294	854.6329	898.9672	853.5738	668.9303	459.8835	478.8668	664.9215	720.0794	686.1255	664.6387	(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	1942.1207	1883.4471	1702.1470	1417.7922	1088.9488	725.4220	469.6269	494.2999	784.2596	1195.8892	1596.7503	1933.9060	(97)
Space heating kWh	927.3517	727.1831	630.5505	373.5540	175.1190	0.0000	0.0000	0.0000	0.0000	354.0025	655.6499	944.3349	(98a)
Space heating requirement - total per year (kWh/year)												4787.7456	
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	927.3517	727.1831	630.5505	373.5540	175.1190	0.0000	0.0000	0.0000	0.0000	354.0025	655.6499	944.3349	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4787.7456	
Space heating per m2										(98c) / (4) =		38.0493	(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	1233.9335	971.3944	995.7640	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7649	0.8475	0.8123	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	943.8079	823.2168	808.8591	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1088.9912	1043.2185	978.0607	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.5320	163.6813	125.8860	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	26.1330	40.9203	31.4715	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												98.5248	(107)
Energy for space heating												38.0493	(99)
Energy for space cooling												0.7830	(108)
Total												38.8323	(109)
Fabric Energy Efficiency (TFEE)												38.8	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800	(1b)	x 2.3100	(2b) =	145.9458	(1b) - (3b)
First floor	62.6500	(1c)	x 2.5600	(2c) =	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		306.3298	(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	1 * 10 =	10.0000 (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) =	10.0000 / (5) =	0.0326 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2326 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1977 (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	0.2521	0.2472	0.2422	0.2175	0.2126	0.1879	0.1879	0.1829	0.1977	0.2126	0.2225	0.2324	(22b)

Mechanical extract ventilation - decentralised

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5021	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 25097.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	199.4528 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705
E3 Sill	12.2700	0.0310	0.3804
E4 Jamb	29.2500	0.0360	1.0530
E5 Ground floor (normal)	32.0700	0.0590	1.8921
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684
E16 Corner (normal)	19.4800	0.0520	1.0130
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957
E14 Flat roof	2.0700	0.0390	0.0807
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	8.8500	0.0470	0.4159
E16 Corner (normal)	1.5000	0.0290	0.0435
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.1177 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	78.1490 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7596	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	(38)
Heat transfer coeff	128.9086	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	(39)
Average = Sum(39)m / 12 =												128.7114	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	(40)
HLP (average)												1.0229	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8833 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)
Hot water usage for baths	31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)
Hot water usage for other uses	44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)
Average daily hot water use (litres/day)												136.0901	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)
Energy content (annual)										Total = Sum(45)m =		2260.4288	
Distribution loss (46)m = 0.15 x (45)m	35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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	5.5285	4.9825	5.4930	5.2664	5.4107	5.2045	5.3579	5.3745	5.2199	5.4302	5.3024	5.5219	(61)
Total heat required for water heating calculated for each month													
	240.0016	211.3002	222.2622	190.3255	180.9935	159.2979	154.5442	162.8593	167.0402	190.7898	208.3773	236.7295	(62)
WWHRS	-64.6160	-57.1469	-59.8410	-49.5507	-46.1795	-39.5161	-37.0400	-39.3884	-40.8849	-48.1988	-54.6034	-63.4194	(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													
	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
									Total per year (kWh/year) = Sum(64)m =			1724.1363	(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													
	79.3444	69.8462	73.4490	62.8488	59.7339	52.5372	50.9439	53.7073	55.1102	62.9896	68.8480	78.2570	(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	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.0528	33.7981	27.4865	20.8090	15.5550	13.1322	14.1898	18.4444	24.7561	31.4335	36.6876	39.1104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	436.7478	441.2799	429.8592	405.5459	374.8547	346.0094	326.7389	322.2068	333.6275	357.9408	388.6320	417.4773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	(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)													
	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)													
	106.6458	103.9379	98.7218	87.2899	80.2876	72.9683	68.4730	72.1873	76.5420	84.6635	95.6222	105.1841	(72)
Total internal gains													
	697.2953	694.8649	671.9165	629.4939	586.5463	544.9589	522.2507	525.6875	547.7746	589.8868	636.7908	677.6208	(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	5.0400	10.6334	0.7300	0.7000	0.7700	18.9783	(74)
North	4.3500	10.6334	0.7300	0.7000	0.7700	16.3800	(74)
East	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(76)
South	6.2600	46.7521	0.7300	0.7000	0.7700	103.6404	(78)
West	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(80)

Solar gains	149.0141	256.8999	363.2999	475.8571	560.7633	570.0677	543.9620	477.8168	401.4385	286.7593	178.9562	127.2674	(83)
Total gains	846.3094	951.7648	1035.2163	1105.3509	1147.3096	1115.0266	1066.2127	1003.5043	949.2131	876.6461	815.7470	804.8882	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.0804	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	
alpha	4.6054	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	
util living area													
	0.9917	0.9848	0.9695	0.9300	0.8387	0.6802	0.5172	0.5675	0.7933	0.9459	0.9853	0.9934	(86)
MIT	19.6309	19.8169	20.1007	20.4482	20.7554	20.9321	20.9846	20.9766	20.8593	20.4691	19.9728	19.5793	(87)
Th 2	20.0630	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	(88)
util rest of house													
	0.9896	0.9810	0.9614	0.9107	0.7946	0.6006	0.4138	0.4622	0.7252	0.9270	0.9808	0.9917	(89)
MIT 2	18.4653	18.7024	19.0603	19.4888	19.8440	20.0196	20.0581	20.0540	19.9584	19.5220	18.9025	18.4006	(90)
Living area fraction										fLA = Living area / (4) =		0.1482	(91)
MIT	18.6381	18.8676	19.2145	19.6310	19.9790	20.1548	20.1955	20.1907	20.0919	19.6623	19.0611	18.5753	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4881	18.7176	19.0645	19.4810	19.8290	20.0048	20.0455	20.0407	19.9419	19.5123	18.9111	18.4253	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9732	0.9499	0.8957	0.7819	0.5952	0.4116	0.4594	0.7150	0.9124	0.9729	0.9872	(94)
Useful gains	833.0587	926.2271	983.3264	990.0452	897.0769	663.6084	438.8433	460.9812	678.7002	799.8172	793.6444	794.5890	(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													
	1828.9648	1778.2329	1616.9694	1361.7040	1046.1551	695.5628	443.4074	468.5376	751.8203	1146.9602	1520.0160	1830.7017	(97)
Space heating kWh													
	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98a)
Space heating requirement - total per year (kWh/year)												3715.5706	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3715.5706	
Space heating per m2											(98c) / (4) =	29.5285	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	832.5327	643.3122	529.6971	300.6677	124.6227	0.0000	0.0000	0.0000	0.0000	290.1960	587.6264	866.1436	(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													
	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6695	88.6339	88.5581	88.4065	88.0592	87.3000	87.3000	87.3000	87.3000	88.3878	88.6079	88.6830	(217)
Fuel for water heating, kWh/month													
	197.7969	173.9214	183.4064	159.2357	153.0947	137.2072	134.5981	141.4330	144.5079	161.3244	173.5443	195.4264	(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	11.0876	10.0146	11.0876	10.7299	11.0876	10.7299	11.0876	11.0876	10.7299	11.0876	10.7299	11.0876	(231)
Lighting	33.3074	26.7204	24.0588	17.6265	13.6152	11.1237	12.4202	16.1443	20.9699	27.5136	31.0765	34.2331	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-31.8419	-45.6323	-66.2758	-75.8428	-83.4934	-78.5753	-77.7789	-72.7502	-64.3428	-52.9826	-35.3907	-27.5129	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.9288	-26.5340	-50.5977	-73.2170	-94.9513	-94.7403	-94.1280	-81.0850	-61.4591	-37.5623	-17.1949	-10.3122	(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												4174.7985	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1955.4964	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 5.3640, total flow = 45.0000, SFP = 0.1192)													
mechanical ventilation fans (SFP = 0.1192)												44.5477	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												130.5477	(231)
Electricity for lighting (calculated in Appendix L)												268.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1367.1302	(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												5162.5218	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4174.7985	3.6400	151.9627	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4964	3.6400	71.1801	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.5477	16.4900	21.5273	(249)
Energy for lighting	268.8095	16.4900	44.3267	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	16.4900	-117.4780	
PV Unit electricity exported	-654.7105	5.5900	-36.5983	
Total			-154.0763	(252)
Total energy cost			226.9204	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4782	(257)
SAP value		92.2483	
SAP rating (Section 12)		92	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4174.7985	0.2100	876.7077	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.4964	0.2100	410.6542	(264)
Space and water heating			1287.3619	(265)
Pumps, fans and electric keep-hot	130.5477	0.1387	18.1086	(267)
Energy for lighting	268.8095	0.1443	38.7975	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	0.1342	-95.5928	
PV Unit electricity exported	-654.7105	0.1268	-83.0057	
Total			-178.5985	(269)
Total CO2, kg/year			1165.6695	(272)
CO2 emissions per m2			9.2600	(273)
EI value			90.8564	
EI rating			91	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800	(1b) x	2.3100	(2b) =	145.9458	(1b) - (3b)
First floor	62.6500	(1c) x	2.5600	(2c) =	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		306.3298	(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	1 * 10 =	10.0000 (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) =	10.0000 / (5) =	0.0326 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2326 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1977 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.2324	0.2274	0.2225	0.2027	0.1977	0.1730	0.1681	0.1681	0.1829	0.1977	0.1977	0.2126	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation												0.5000	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000	(23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25097.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.4528 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705

E3 Sill	12.2700	0.0310	0.3804	
E4 Jamb	29.2500	0.0360	1.0530	
E5 Ground floor (normal)	32.0700	0.0590	1.8921	
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904	
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160	
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684	
E16 Corner (normal)	19.4800	0.0520	1.0130	
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957	
E14 Flat roof	2.0700	0.0390	0.0807	
E4 Jamb	3.0000	0.0830	0.2490	
E4 Jamb	8.8500	0.0470	0.4159	
E16 Corner (normal)	1.5000	0.0290	0.0435	
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1177 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.1490 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	(38)
Heat transfer coeff	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	(39)
Average = Sum(39)m / 12 =												128.6934	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	(40)
HLP (average)												1.0228	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8833 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)
Hot water usage for baths	31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)
Hot water usage for other uses	44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)
Average daily hot water use (litres/day)												136.0901	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)
Energy content (annual)										Total = Sum(45)m =		2260.4288	
Distribution loss (46)m = 0.15 x (45)m	35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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	5.5285	4.9825	5.4930	5.2664	5.4107	5.2045	5.3579	5.3745	5.2199	5.4302	5.3024	5.5219	(61)
Total heat required for water heating calculated for each month	240.0016	211.3002	222.2622	190.3255	180.9935	159.2979	154.5442	162.8593	167.0402	190.7898	208.3773	236.7295	(62)
WWHRS	-64.6160	-57.1469	-59.8410	-49.5507	-46.1795	-39.5161	-37.0400	-39.3884	-40.8849	-48.1988	-54.6034	-63.4194	(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	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
										Total per year (kWh/year) = Sum(64)m =		1724.1363	(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	79.3444	69.8462	73.4490	62.8488	59.7339	52.5372	50.9439	53.7073	55.1102	62.9896	68.8480	78.2570	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.0528	33.7981	27.4865	20.8090	15.5550	13.1322	14.1898	18.4444	24.7561	31.4335	36.6876	39.1104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7478	441.2799	429.8592	405.5459	374.8547	346.0094	326.7389	322.2068	333.6275	357.9408	388.6320	417.4773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	(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)	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)	106.6458	103.9379	98.7218	87.2899	80.2876	72.9683	68.4730	72.1873	76.5420	84.6635	95.6222	105.1841	(72)
Total internal gains	697.2953	694.8649	671.9165	629.4939	586.5463	544.9589	522.2507	525.6875	547.7746	589.8868	636.7908	677.6208	(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	5.0400	12.4405	0.7300	0.7000	0.7700	22.2036	(74)
North	4.3500	12.4405	0.7300	0.7000	0.7700	19.1638	(74)
East	0.7200	23.1469	0.7300	0.7000	0.7700	5.9017	(76)
South	6.2600	53.3164	0.7300	0.7000	0.7700	118.1923	(78)
West	0.7200	23.1469	0.7300	0.7000	0.7700	5.9017	(80)

Solar gains	171.3632	262.1601	368.3335	492.7736	567.0342	614.4849	571.1561	507.3894	426.3463	303.0543	198.8487	140.2420	(83)
Total gains	868.6585	957.0250	1040.2499	1122.2674	1153.5805	1159.4438	1093.4068	1033.0770	974.1208	892.9411	835.6394	817.8628	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	
alpha	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	
util living area	0.9910	0.9852	0.9697	0.9266	0.8323	0.6445	0.4951	0.5321	0.7818	0.9426	0.9843	0.9933	(86)
MIT	19.6432	19.7958	20.0926	20.4606	20.7666	20.9472	20.9874	20.9827	20.8681	20.4820	19.9789	19.5658	(87)
Th 2	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	(88)
util rest of house	0.9887	0.9815	0.9617	0.9066	0.7869	0.5629	0.3926	0.4264	0.7125	0.9227	0.9796	0.9916	(89)
MIT 2	18.4818	18.6756	19.0500	19.5033	19.8559	20.0312	20.0595	20.0573	19.9660	19.5371	18.9100	18.3832	(90)
Living area fraction										fLA = Living area / (4) =		0.1482	(91)
MIT	18.6539	18.8416	19.2045	19.6452	19.9909	20.1669	20.1970	20.1945	20.0997	19.6771	19.0685	18.5585	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5039	18.6916	19.0545	19.4952	19.8409	20.0169	20.0470	20.0445	19.9497	19.5271	18.9185	18.4085	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9738	0.9503	0.8915	0.7745	0.5585	0.3907	0.4241	0.7028	0.9079	0.9714	0.9870	(94)
Useful gains	854.0710	931.9922	988.5044	1000.5570	893.3914	647.5203	427.1644	438.1223	684.6547	810.7263	811.7311	807.2670	(95)
Ext temp.	4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W	1840.8231	1800.6270	1628.5574	1363.5314	1034.8050	671.3843	430.7408	443.2812	752.8195	1148.8650	1533.8276	1854.2810	(97)
Space heating kWh	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98a)
Space heating requirement - total per year (kWh/year)												3711.0820	
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	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3711.0820	
Space heating per m2											(98c) / (4) =	29.4928	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	824.8804	655.8681	535.0556	293.6422	118.2154	0.0000	0.0000	0.0000	0.0000	282.6688	584.1680	875.2567	(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	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6671	88.6394	88.5614	88.3974	88.0371	87.3000	87.3000	87.3000	87.3000	88.3774	88.6062	88.6857	(217)
Fuel for water heating, kWh/month	197.8024	173.9105	183.3996	159.2523	153.1332	137.2072	134.5981	141.4330	144.5079	161.3432	173.5478	195.4205	(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	11.0876	10.0146	11.0876	10.7299	11.0876	10.7299	11.0876	11.0876	10.7299	11.0876	10.7299	11.0876	(231)
Lighting	33.3074	26.7204	24.0588	17.6265	13.6152	11.1237	12.4202	16.1443	20.9699	27.5136	31.0765	34.2331	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.9072	-46.5513	-67.0530	-77.5058	-83.8458	-81.8863	-79.8312	-75.3367	-66.9592	-55.3330	-38.6758	-30.0067	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-15.9365	-27.5227	-51.7584	-76.5980	-95.8326	-104.0225	-99.8324	-87.5402	-66.7735	-40.8230	-20.1485	-11.9711	(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	4169.7551	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1955.5556	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 5.3640, total flow = 45.0000, SFP = 0.1192)

mechanical ventilation fans (SFP = 0.1192) 44.5477 (230a)

central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	130.5477	(231)
Electricity for lighting (calculated in Appendix L)	268.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1437.6514	(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	5087.0165	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4169.7551	6.1900	258.1078	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.5556	6.1900	121.0489	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.5477	25.1600	32.8458	(249)
Energy for lighting	268.8095	25.1600	67.6325	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	25.1600	-185.9052	
PV Unit electricity exported	-698.7594	5.8100	-40.5979	
Total			-226.5032	(252)
Total energy cost			355.1319	(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	4169.7551	0.2100	875.6486	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.5556	0.2100	410.6667	(264)
Space and water heating			1286.3152	(265)
Pumps, fans and electric keep-hot	130.5477	0.1387	18.1086	(267)
Energy for lighting	268.8095	0.1443	38.7975	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	0.1343	-99.2619	
PV Unit electricity exported	-698.7594	0.1268	-88.5868	
Total			-187.8487	(269)
Total CO2, kg/year			1155.3726	(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	4169.7551	1.1300	4711.8233	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.5556	1.1300	2209.7778	(278)
Space and water heating			6921.6011	(279)
Pumps, fans and electric keep-hot	130.5477	1.5128	197.4926	(281)
Energy for lighting	268.8095	1.5338	412.3090	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	1.4965	-1105.7245	
PV Unit electricity exported	-698.7594	0.4653	-325.1573	
Total			-1430.8818	(283)
Total Primary energy kWh/year			6100.5209	(286)

SAP 10 EPC IMPROVEMENTS

1

Current energy efficiency rating: A 92
Current environmental impact rating: B 91

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

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.4	-£ 22	-130 kg (11.2%)

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

Potential energy efficiency rating: A 92
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)

Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£100	£100	£0
Mains gas	£481	£481	£0
Space heating	£393	£393	£0
Water heating	£121	£121	£0
Lighting	£68	£68	£0
Generated (PV)	-£227	-£227	£0
Total cost of fuels	£354	£354	£0
Total cost of uses	£355	£355	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.2 tonnes	0.0 tonnes
CO2 emissions per m²	9 kg/m²	9 kg/m²	0 kg/m²
Primary energy	48 kWh/m²	48 kWh/m²	0 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800	(1b)	x 2.3100	(2b)	= 145.9458	(1b) - (3b)
First floor	62.6500	(1c)	x 2.5600	(2c)	= 160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	125.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 306.3298	(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	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0326	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2326	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1977	(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	0.2521	0.2472	0.2422	0.2175	0.2126	0.1879	0.1879	0.1829	0.1977	0.2126	0.2225	0.2324	(22b)

Mechanical extract ventilation - decentralised

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5021	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	25097.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		199.4528 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total

E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705	
E3 Sill	12.2700	0.0310	0.3804	
E4 Jamb	29.2500	0.0360	1.0530	
E5 Ground floor (normal)	32.0700	0.0590	1.8921	
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904	
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160	
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684	
E16 Corner (normal)	19.4800	0.0520	1.0130	
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957	
E14 Flat roof	2.0700	0.0390	0.0807	
E4 Jamb	3.0000	0.0830	0.2490	
E4 Jamb	8.8500	0.0470	0.4159	
E16 Corner (normal)	1.5000	0.0290	0.0435	
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.1177 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 78.1490 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.7596	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	(38)
Heat transfer coeff	128.9086	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	(39)

Average = Sum(39)m / 12 = 128.7114

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0245	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	(40)
HLP (average)												1.0229	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8833 (42)

Hot water usage for mixer showers

72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)

Hot water usage for baths

31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)

Hot water usage for other uses

44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)

Average daily hot water use (litres/day) 136.0901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)

Energy content (annual) Total = Sum(45)m = 2260.4288

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

35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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 5.5285	4.9825	5.4930	5.2664	5.4107	5.2045	5.3579	5.3745	5.2199	5.4302	5.3024	5.5219	(61)

Total heat required for water heating calculated for each month

240.0016	211.3002	222.2622	190.3255	180.9935	159.2979	154.5442	162.8593	167.0402	190.7898	208.3773	236.7295	(62)
WWHRS -64.6160	-57.1469	-59.8410	-49.5507	-46.1795	-39.5161	-37.0400	-39.3884	-40.8849	-48.1988	-54.6034	-63.4194	(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

175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)

Total per year (kWh/year) = Sum(64)m = 1724.1363 (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

79.3444	69.8462	73.4490	62.8488	59.7339	52.5372	50.9439	53.7073	55.1102	62.9896	68.8480	78.2570	(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	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	38.0528	33.7981	27.4865	20.8090	15.5550	13.1322	14.1898	18.4444	24.7561	31.4335	36.6876	39.1104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	436.7478	441.2799	429.8592	405.5459	374.8547	346.0094	326.7389	322.2068	333.6275	357.9408	388.6320	417.4773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	(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)	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)	106.6458	103.9379	98.7218	87.2899	80.2876	72.9683	68.4730	72.1873	76.5420	84.6635	95.6222	105.1841	(72)
Total internal gains	697.2953	694.8649	671.9165	629.4939	586.5463	544.9589	522.2507	525.6875	547.7746	589.8868	636.7908	677.6208	(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	5.0400	10.6334	0.7300	0.7000	0.7700	18.9783	(74)
North	4.3500	10.6334	0.7300	0.7000	0.7700	16.3800	(74)
East	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(76)
South	6.2600	46.7521	0.7300	0.7000	0.7700	103.6404	(78)
West	0.7200	19.6403	0.7300	0.7000	0.7700	5.0076	(80)

Solar gains	149.0141	256.8999	363.2999	475.8571	560.7633	570.0677	543.9620	477.8168	401.4385	286.7593	178.9562	127.2674	(83)
Total gains	846.3094	951.7648	1035.2163	1105.3509	1147.3096	1115.0266	1066.2127	1003.5043	949.2131	876.6461	815.7470	804.8882	(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	54.0804	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	
alpha	4.6054	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	
util living area	0.9917	0.9848	0.9695	0.9300	0.8387	0.6802	0.5172	0.5675	0.7933	0.9459	0.9853	0.9934	(86)
MIT	19.6309	19.8169	20.1007	20.4482	20.7554	20.9321	20.9846	20.9766	20.8593	20.4691	19.9728	19.5793	(87)
Th 2	20.0630	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	(88)
util rest of house	0.9896	0.9810	0.9614	0.9107	0.7946	0.6006	0.4138	0.4622	0.7252	0.9270	0.9808	0.9917	(89)
MIT 2	18.4653	18.7024	19.0603	19.4888	19.8440	20.0196	20.0581	20.0540	19.9584	19.5220	18.9025	18.4006	(90)
Living area fraction									fLA = Living area / (4) =			0.1482	(91)
MIT	18.6381	18.8676	19.2145	19.6310	19.9790	20.1548	20.1955	20.1907	20.0919	19.6623	19.0611	18.5753	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4881	18.7176	19.0645	19.4810	19.8290	20.0048	20.0455	20.0407	19.9419	19.5123	18.9111	18.4253	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9732	0.9499	0.8957	0.7819	0.5952	0.4116	0.4594	0.7150	0.9124	0.9729	0.9872	(94)
Useful gains	833.0587	926.2271	983.3264	990.0452	897.0769	663.6084	438.8433	460.9812	678.7002	799.8172	793.6444	794.5890	(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	1828.9648	1778.2329	1616.9694	1361.7040	1046.1551	695.5628	443.4074	468.5376	751.8203	1146.9602	1520.0160	1830.7017	(97)
Space heating kWh	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98a)
Space heating requirement - total per year (kWh/year)												3715.5706	
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3715.5706	
Space heating per m2											(98c) / (4) =	29.5285	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	740.9541	572.5479	471.4304	267.5943	110.9142	0.0000	0.0000	0.0000	0.0000	258.2744	522.9875	770.8678	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	832.5327	643.3122	529.6971	300.6677	124.6227	0.0000	0.0000	0.0000	0.0000	290.1960	587.6264	866.1436	(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	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6695	88.6339	88.5581	88.4065	88.0592	87.3000	87.3000	87.3000	87.3000	88.3878	88.6079	88.6830	(217)
Fuel for water heating, kWh/month	197.7969	173.9214	183.4064	159.2357	153.0947	137.2072	134.5981	141.4330	144.5079	161.3244	173.5443	195.4264	(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	11.0876	10.0146	11.0876	10.7299	11.0876	10.7299	11.0876	11.0876	10.7299	11.0876	10.7299	11.0876	(231)
Lighting	33.3074	26.7204	24.0588	17.6265	13.6152	11.1237	12.4202	16.1443	20.9699	27.5136	31.0765	34.2331	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-31.8419	-45.6323	-66.2758	-75.8428	-83.4934	-78.5753	-77.7789	-72.7502	-64.3428	-52.9826	-35.3907	-27.5129	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-12.9288	-26.5340	-50.5977	-73.2170	-94.9513	-94.7403	-94.1280	-81.0850	-61.4591	-37.5623	-17.1949	-10.3122	(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												4174.7985	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.3000	
Water heating fuel used												1955.4964	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:
(MEVDecentralised, Database: total watage = 5.3640, total flow = 45.0000, SFP = 0.1192)

mechanical ventilation fans (SFP = 0.1192)	44.5477	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	130.5477	(231)
Electricity for lighting (calculated in Appendix L)	268.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1367.1302	(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	5162.5218	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4174.7985	3.6400	151.9627	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.4964	3.6400	71.1801	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	130.5477	16.4900	21.5273	(249)
Energy for lighting	268.8095	16.4900	44.3267	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	16.4900	-117.4780	
PV Unit electricity exported	-654.7105	5.5900	-36.5983	
Total			-154.0763	(252)
Total energy cost			226.9204	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.4782	(257)
SAP value	92.2483	
SAP rating (Section 12)	92	(258)
SAP band	A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4174.7985	0.2100	876.7077	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.4964	0.2100	410.6542	(264)
Space and water heating			1287.3619	(265)
Pumps, fans and electric keep-hot	130.5477	0.1387	18.1086	(267)
Energy for lighting	268.8095	0.1443	38.7975	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-712.4197	0.1342	-95.5928	
PV Unit electricity exported	-654.7105	0.1268	-83.0057	
Total			-178.5985	(269)
Total CO2, kg/year			1165.6695	(272)
CO2 emissions per m2			9.2600	(273)
EI value			90.8564	
EI rating			91	(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 FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	63.1800	(1b)	x 2.3100	(2b) =	145.9458	(1b) - (3b)
First floor	62.6500	(1c)	x 2.5600	(2c) =	160.3840	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 125.8300						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		306.3298	(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	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0326 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.2326 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1977 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.2324	0.2274	0.2225	0.2027	0.1977	0.1730	0.1681	0.1681	0.1829	0.1977	0.1977	0.2126	(22b)

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH FD Type 1 (IG)			2.3700	1.2000	2.8440			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.0400	1.2357	6.2281			(27)
Window - Eurcell Logik (Uw = 1.30)			12.0500	1.2357	14.8907			(27)
DWH Side/Rear Door (IG)			2.0000	1.3000	2.6000			(26a)
B&B 225mm TE Platinum GF			63.1800	0.1100	6.9498	135.0000	8529.3000	(28a)
Full Fill Bead	155.3300	21.4600	133.8700	0.2300	30.7901	60.0000	8032.2001	(29a)
500mm Mineral Wool @ 0.040	62.6500		62.6500	0.0900	5.6385	10.0000	626.5000	(30)
Flat Roofs (GRP Bays, Light Po	0.5300		0.5300	0.1700	0.0901	9.0000	4.7700	(30)
Total net area of external elements Aum(A, m2)			281.6900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.0313			(33)
100mm Solid			61.2100			75.0000	4590.7499	(32c)
63mm Timber			180.2300			9.0000	1622.0700	(32c)
1st floor			62.6500			18.0000	1127.7000	(32d)
Ground ceiling			62.6500			9.0000	563.8500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 25097.1400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	199.4528 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.2500	0.0260	0.3705
E3 Sill	12.2700	0.0310	0.3804
E4 Jamb	29.2500	0.0360	1.0530
E5 Ground floor (normal)	32.0700	0.0590	1.8921
E6 Intermediate floor within a dwelling	31.7400	0.0060	0.1904
E10 Eaves (insulation at ceiling level)	14.7500	0.0960	1.4160
E12 Gable (insulation at ceiling level)	16.9900	0.0570	0.9684
E16 Corner (normal)	19.4800	0.0520	1.0130
E24 Eaves (insulation at ceiling level - inverted)	1.7400	0.0550	0.0957
E14 Flat roof	2.0700	0.0390	0.0807
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	8.8500	0.0470	0.4159
E16 Corner (normal)	1.5000	0.0290	0.0435
E17 Corner (inverted - internal area greater than external area)	1.5000	-0.0340	-0.0510

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.1177 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	78.1490 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	50.5444	(38)
Heat transfer coeff	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	128.6934	(39)
Average = Sum(39)m / 12 =												128.6934	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	1.0228	(40)
HLP (average)												1.0228	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.8833 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
72.5632	71.4727	69.8837	66.8433	64.5996	62.0975	60.6752	62.2522	63.9810	66.6675	69.7732	72.2852	(42a)

Hot water usage for baths

31.3278	30.8625	30.2073	28.9993	28.0947	27.0917	26.5499	27.2005	27.9089	28.9822	30.2151	31.2219	(42b)

Hot water usage for other uses

44.1578	42.5521	40.9464	39.3406	37.7349	36.1291	36.1291	37.7349	39.3406	40.9464	42.5521	44.1578	(42c)

Average daily hot water use (litres/day)	136.0901 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	148.0488	144.8874	141.0374	135.1832	130.4292	125.3183	123.3543	127.1876	131.2305	136.5961	142.5404	147.6649	(44)
Energy conte	234.4732	206.3177	216.7692	185.0591	175.5828	154.0935	149.1863	157.4849	161.8203	185.3596	203.0749	231.2076	(45)
Energy content (annual)										Total = Sum(45)m =		2260.4288	

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

35.1710	30.9476	32.5154	27.7589	26.3374	23.1140	22.3779	23.6227	24.2730	27.8039	30.4612	34.6811	(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 5.5285	4.9825	5.4930	5.2664	5.4107	5.2045	5.3579	5.3745	5.2199	5.4302	5.3024	5.5219	(61)

Total heat required for water heating calculated for each month

	240.0016	211.3002	222.2622	190.3255	180.9935	159.2979	154.5442	162.8593	167.0402	190.7898	208.3773	236.7295	(62)
WWHRS	-64.6160	-57.1469	-59.8410	-49.5507	-46.1795	-39.5161	-37.0400	-39.3884	-40.8849	-48.1988	-54.6034	-63.4194	(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													
	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
										Total per year (kWh/year) = Sum(64)m =		1724.1363	(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													
	79.3444	69.8462	73.4490	62.8488	59.7339	52.5372	50.9439	53.7073	55.1102	62.9896	68.8480	78.2570	(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	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	172.9978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	38.0528	33.7981	27.4865	20.8090	15.5550	13.1322	14.1898	18.4444	24.7561	31.4335	36.6876	39.1104	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	436.7478	441.2799	429.8592	405.5459	374.8547	346.0094	326.7389	322.2068	333.6275	357.9408	388.6320	417.4773	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	55.1831	(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)													
	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	-115.3318	(71)
Water heating gains (Table 5)													
	106.6458	103.9379	98.7218	87.2899	80.2876	72.9683	68.4730	72.1873	76.5420	84.6635	95.6222	105.1841	(72)
Total internal gains													
	697.2953	694.8649	671.9165	629.4939	586.5463	544.9589	522.2507	525.6875	547.7746	589.8868	636.7908	677.6208	(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	5.0400	12.4405	0.7300	0.7000	0.7700	22.2036	(74)
North	4.3500	12.4405	0.7300	0.7000	0.7700	19.1638	(74)
East	0.7200	23.1469	0.7300	0.7000	0.7700	5.9017	(76)
South	6.2600	53.3164	0.7300	0.7000	0.7700	118.1923	(78)
West	0.7200	23.1469	0.7300	0.7000	0.7700	5.9017	(80)

Solar gains	171.3632	262.1601	368.3335	492.7736	567.0342	614.4849	571.1561	507.3894	426.3463	303.0543	198.8487	140.2420	(83)
Total gains	868.6585	957.0250	1040.2499	1122.2674	1153.5805	1159.4438	1093.4068	1033.0770	974.1208	892.9411	835.6394	817.8628	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	54.1708	
alpha	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	4.6114	
util living area													
	0.9910	0.9852	0.9697	0.9266	0.8323	0.6445	0.4951	0.5321	0.7818	0.9426	0.9843	0.9933	(86)
MIT	19.6432	19.7958	20.0926	20.4606	20.7666	20.9472	20.9874	20.9827	20.8681	20.4820	19.9789	19.5658	(87)
Th 2	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	20.0644	(88)
util rest of house													
	0.9887	0.9815	0.9617	0.9066	0.7869	0.5629	0.3926	0.4264	0.7125	0.9227	0.9796	0.9916	(89)
MIT 2	18.4818	18.6756	19.0500	19.5033	19.8559	20.0312	20.0595	20.0573	19.9660	19.5371	18.9100	18.3832	(90)
Living area fraction										fLA = Living area / (4) =		0.1482	(91)
MIT	18.6539	18.8416	19.2045	19.6452	19.9909	20.1669	20.1970	20.1945	20.0997	19.6771	19.0685	18.5585	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5039	18.6916	19.0545	19.4952	19.8409	20.0169	20.0470	20.0445	19.9497	19.5271	18.9185	18.4085	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9738	0.9503	0.8915	0.7745	0.5585	0.3907	0.4241	0.7028	0.9079	0.9714	0.9870	(94)
Useful gains	854.0710	931.9922	988.5044	1000.5570	893.3914	647.5203	427.1644	438.1223	684.6547	810.7263	811.7311	807.2670	(95)
Ext temp.	4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W													
	1840.8231	1800.6270	1628.5574	1363.5314	1034.8050	671.3843	430.7408	443.2812	752.8195	1148.8650	1533.8276	1854.2810	(97)
Space heating kWh													
	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98a)
Space heating requirement - total per year (kWh/year)												3711.0820	
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													
	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3711.0820	
Space heating per m2											(98c) / (4) =	29.4928	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	734.1435	583.7226	476.1995	261.3416	105.2117	0.0000	0.0000	0.0000	0.0000	251.5752	519.9095	778.9784	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	824.8804	655.8681	535.0556	293.6422	118.2154	0.0000	0.0000	0.0000	0.0000	282.6688	584.1680	875.2567	(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	175.3856	154.1532	162.4213	140.7748	134.8140	119.7818	117.5041	123.4710	126.1554	142.5910	153.7740	173.3101	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.6671	88.6394	88.5614	88.3974	88.0371	87.3000	87.3000	87.3000	87.3000	88.3774	88.6062	88.6857	(217)
Fuel for water heating, kWh/month	197.8024	173.9105	183.3996	159.2523	153.1332	137.2072	134.5981	141.4330	144.5079	161.3432	173.5478	195.4205	(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	11.0876	10.0146	11.0876	10.7299	11.0876	10.7299	11.0876	11.0876	10.7299	11.0876	10.7299	11.0876	(231)
Lighting	33.3074	26.7204	24.0588	17.6265	13.6152	11.1237	12.4202	16.1443	20.9699	27.5136	31.0765	34.2331	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.9072	-46.5513	-67.0530	-77.5058	-83.8458	-81.8863	-79.8312	-75.3367	-66.9592	-55.3330	-38.6758	-30.0067	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-15.9365	-27.5227	-51.7584	-76.5980	-95.8326	-104.0225	-99.8324	-87.5402	-66.7735	-40.8230	-20.1485	-11.9711	(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	4169.7551	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1955.5556	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.3640, total flow = 45.0000, SFP = 0.1192)		
mechanical ventilation fans (SFP = 0.1192)	44.5477	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	130.5477	(231)
Electricity for lighting (calculated in Appendix L)	268.8095	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1437.6514	(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	5087.0165	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4169.7551	6.1900	258.1078	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.5556	6.1900	121.0489	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	130.5477	25.1600	32.8458	(249)
Energy for lighting	268.8095	25.1600	67.6325	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	25.1600	-185.9052	
PV Unit electricity exported	-698.7594	5.8100	-40.5979	
Total			-226.5032	(252)
Total energy cost			355.1319	(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	4169.7551	0.2100	875.6486	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1955.5556	0.2100	410.6667	(264)
Space and water heating			1286.3152	(265)
Pumps, fans and electric keep-hot	130.5477	0.1387	18.1086	(267)
Energy for lighting	268.8095	0.1443	38.7975	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	0.1343	-99.2619	
PV Unit electricity exported	-698.7594	0.1268	-88.5868	
Total			-187.8487	(269)
Total CO2, kg/year			1155.3726	(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	4169.7551	1.1300	4711.8233	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1955.5556	1.1300	2209.7778	(278)
Space and water heating			6921.6011	(279)
Pumps, fans and electric keep-hot	130.5477	1.5128	197.4926	(281)
Energy for lighting	268.8095	1.5338	412.3090	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-738.8920	1.4965	-1105.7245	
PV Unit electricity exported	-698.7594	0.4653	-325.1573	
Total			-1430.8818	(283)
Total Primary energy kWh/year			6100.5209	(286)

Full SAP Calculation Printout

Property Reference	Plot 129 P286 09NG ET	**Issued on Date**	18/03/2024
Assessment Reference	1	**Prop Type Ref**	1
Property	Plot 129, The Pavilions, Bodicote, OX15		

SAP Rating	91 B	**DER**	10.19	**TER**	12.16
Environmental	92 A	**% DER < TER**			16.20
CO_2 Emissions (t/year)	0.66	**DFEE**	32.62	**TFEE**	34.30
Compliance Check	See BREL	**% DFEE < TFEE**			4.88
% DPER < TPER	14.56	**DPER**	54.31	**TPER**	63.57

Assessor Details	Ms. Alina Spataru	**Assessor ID**	BD89-0001
Client	BDW Mercia, BDW Mercia		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	34.1300 (1b)	x	2.3100 (2b)	=	78.8403	(1b) - (3b)
First floor	34.1300 (1c)	x	2.5500 (2c)	=	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	165.8718	(5)

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2. Ventilation rate

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

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

Mechanical extract ventilation - decentralised

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15048.0301	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	220.4517	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3	Sill	5.8300	0.0310	0.1807
E4	Jamb	24.7500	0.0360	0.8910
E5	Ground floor (normal)	16.6300	0.0590	0.9812
E6	Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12	Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10	Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16	Corner (normal)	9.7200	0.0520	0.5054
E18	Party wall between dwellings	9.7200	0.0530	0.5152
P1	Party wall - Ground floor	7.3900	0.0860	0.6355
P2	Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4	Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.7731 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.1326 (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	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	(38)
Heat transfer coeff	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	(39)

Average = Sum(39)m / 12 = 72.5015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	(40)
HLP (average)												1.0621	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2032 (42)

Hot water usage for mixer showers

61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249	(42a)

Hot water usage for baths

26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)

Hot water usage for other uses

37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)

Average daily hot water use (litres/day) 114.6970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)

Energy content (annual) Total = Sum(45)m = 1905.0938

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

29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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 5.4547	4.9177	5.4249	5.2082	5.3555	5.1560	5.3110	5.3250	5.1691	5.3720	5.2386	5.4492	(61)

Total heat required for water heating calculated for each month

203.0685	178.8027	188.1191	161.1770	153.3378	135.0272	131.0458	138.0534	141.5510	161.5927	176.3899	200.3106	(62)
WWHRS -54.4610	-48.1658	-50.4364	-41.7633	-38.9219	-33.3058	-31.2189	-33.1981	-34.4594	-40.6239	-46.0219	-53.4525	(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

148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)

Total per year (kWh/year) = Sum(64)m = 1462.4467 (64)

12Total per year (kWh/year) 1462 (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

67.0703	59.0462	62.1020	53.1617	50.5430	44.4712	43.1346	45.4634	46.6393	53.2864	58.2175	66.1537	(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	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.1914	110.9262	100.1914	103.5311	100.1914	103.5311	100.1914	100.1914	103.5311	100.1914	103.5311	100.1914	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.2024	195.2072	190.1551	179.3998	165.8230	153.0628	144.5382	142.5334	147.5855	158.3409	171.9176	184.6778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	(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)	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)	90.1482	87.8663	83.4705	73.8356	67.9341	61.7655	57.9766	61.1068	64.7768	71.6215	80.8576	88.9163	(72)
Total internal gains	442.5893	453.0470	432.8643	415.8138	392.9958	374.4067	358.7535	359.8788	371.9406	389.2010	415.3536	432.8327	(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	
South	5.1200	46.7521	0.7300	0.7000	0.7700	84.7666	(78)
North	4.1400	10.6334	0.7300	0.7000	0.7700	15.5893	(74)
South	1.8500	46.7521	0.7300	0.7000	0.7700	30.6286	(78)
West	0.7000	19.6403	0.7300	0.7000	0.7700	4.8685	(80)

Solar gains	135.8530	228.3034	307.0450	376.2744	421.1016	418.8202	403.4016	369.2327	330.5858	250.6052	162.0846	116.7117	(83)
Total gains	578.4423	681.3505	739.9092	792.0882	814.0974	793.2269	762.1551	729.1115	702.5264	639.8062	577.4381	549.5445	(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	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	
alpha	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	
util living area	0.9852	0.9679	0.9380	0.8683	0.7427	0.5661	0.4150	0.4517	0.6662	0.8892	0.9701	0.9883	(86)
MIT	19.8699	20.1046	20.3700	20.6658	20.8772	20.9736	20.9952	20.9927	20.9431	20.6736	20.2107	19.8098	(87)
Th 2	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	(88)
util rest of house	0.9813	0.9598	0.9224	0.8365	0.6873	0.4879	0.3255	0.3595	0.5888	0.8552	0.9610	0.9851	(89)
MIT 2	18.7353	19.0292	19.3562	19.7050	19.9311	20.0165	20.0302	20.0291	19.9947	19.7227	19.1660	18.6595	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	19.0614	19.3383	19.6476	19.9812	20.2031	20.2916	20.3076	20.3061	20.2673	19.9960	19.4663	18.9902	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.9114	19.1883	19.4976	19.8312	20.0531	20.1416	20.1576	20.1561	20.1173	19.8460	19.3163	18.8402	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9751	0.9508	0.9120	0.8291	0.6886	0.4971	0.3372	0.3715	0.5960	0.8476	0.9522	0.9797	(94)
Useful gains	564.0104	647.8010	674.8021	656.7215	560.6178	394.2816	257.0290	270.8706	418.7308	542.3035	549.8641	538.3779	(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	1059.3504	1035.9213	942.3467	792.5254	605.6100	401.7740	257.9280	272.3218	436.2653	670.3487	885.6962	1061.4330	(97)
Space heating kWh	368.5329	260.8168	199.0532	97.7788	33.4741	0.0000	0.0000	0.0000	0.0000	95.2656	241.7992	389.1530	(98a)
Space heating requirement - total per year (kWh/year)												1685.8737	
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	368.5329	260.8168	199.0532	97.7788	33.4741	0.0000	0.0000	0.0000	0.0000	95.2656	241.7992	389.1530	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1685.8737	
Space heating per m2											(98c) / (4) =	24.6978	(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 %)												89.0000	(206)
Efficiency of main space heating system 2 (in %)												0.0000	(207)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	368.5329	260.8168	199.0532	97.7788	33.4741	0.0000	0.0000	0.0000	0.0000	95.2656	241.7992	389.1530	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	414.0819	293.0526	223.6553	109.8639	37.6114	0.0000	0.0000	0.0000	0.0000	107.0400	271.6844	437.2506	(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	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.5047	88.4254	88.2970	88.0572	87.6791	87.3000	87.3000	87.3000	87.3000	88.0409	88.3970	88.5277	(217)
Fuel for water heating, kWh/month	167.9090	147.7369	155.9314	135.6091	130.4939	116.5194	114.3494	120.1091	122.6708	137.4007	147.4801	165.8895	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.5311	8.6087	9.5311	9.2236	9.5311	9.2236	9.5311	9.5311	9.2236	9.5311	9.2236	9.5311	(231)
Lighting	19.2996	15.4829	13.9406	10.2135	7.8892	6.4455	7.1968	9.3547	12.1508	15.9425	18.0070	19.8360	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6969	-24.3299	-35.9017	-41.7594	-46.5817	-44.0826	-43.6637	-40.5567	-35.4268	-28.5857	-18.7083	-14.3823	(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	-5.6885	-11.7532	-22.5350	-32.7705	-42.6407	-42.5752	-42.2897	-36.3608	-27.4742	-16.6867	-7.5846	-4.5303	(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	1894.2401	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1662.0993	(219)
Space cooling fuel	0.0000	(221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 5.4420, total flow = 42.0000, SFP = 0.1296)

mechanical ventilation fans (SFP = 0.1296)	26.2205	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.2205	(231)
Electricity for lighting (calculated in Appendix L)	155.7591	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.5651	(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	3140.7539	(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	1894.2401	0.2100	397.7904	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1662.0993	0.2100	349.0408	(264)
Space and water heating			746.8313	(265)
Pumps, fans and electric keep-hot	112.2205	0.1387	15.5664	(267)
Energy for lighting	155.7591	0.1443	22.4809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	0.1338	-52.2856	
PV Unit electricity exported	-292.8894	0.1266	-37.0906	
Total			-89.3762	(269)
Total CO2, kg/year			695.5023	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.1900	(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	1894.2401	1.1300	2140.4913	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.0993	1.1300	1878.1722	(278)
Space and water heating			4018.6635	(279)
Pumps, fans and electric keep-hot	112.2205	1.5128	169.7672	(281)
Energy for lighting	155.7591	1.5338	238.9085	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	1.4946	-583.8972	
PV Unit electricity exported	-292.8894	0.4649	-136.1573	
Total			-720.0546	(283)
Total Primary energy kWh/year			3707.2847	(286)
Dwelling Primary energy Rate (DPER)			54.3100	(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)	
Ground floor	34.1300 (1b)	x	2.3100 (2b)	=	78.8403	(1b) - (3b)
First floor	34.1300 (1c)	x	2.5500 (2c)	=	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 68.2600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	165.8718	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1206	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3706	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3150	(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	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701	(22b)
Effective ac	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.4900	1.0000	2.4900			(26)
TER Opening Type (Uw = 1.20)			11.8100	1.1450	13.5229			(27)
B&B 225mm TE Platinum GF			34.1300	0.1300	4.4369			(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.1800	11.9682			(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.1100	3.7543			(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.1723			(33)
E-WM-22			35.9300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.4517 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3400	0.0500	0.4670
E3 Sill	5.8300	0.0500	0.2915
E4 Jamb	24.7500	0.0500	1.2375
E5 Ground floor (normal)	16.6300	0.1600	2.6608
E6 Intermediate floor within a dwelling	16.6300	0.0000	0.0000
E12 Gable (insulation at ceiling level)	9.2300	0.0600	0.5538
E10 Eaves (insulation at ceiling level)	7.3900	0.0600	0.4434
E16 Corner (normal)	9.7200	0.0900	0.8748
E18 Party wall between dwellings	9.7200	0.0600	0.5832
P1 Party wall - Ground floor	7.3900	0.0800	0.5912
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.1200	0.8868

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.5900 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 44.7623 (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	31.7832	31.6118	31.4438	30.6546	30.5069	29.8196	29.8196	29.6923	30.0843	30.5069	30.8056	31.1179	(38)
Heat transfer coeff	76.5455	76.3741	76.2061	75.4169	75.2692	74.5819	74.5819	74.4546	74.8466	75.2692	75.5679	75.8802	(39)
Average = Sum(39)m / 12 =												75.4162	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1214	1.1189	1.1164	1.1048	1.1027	1.0926	1.0926	1.0907	1.0965	1.1027	1.1071	1.1116	(40)
HLP (average)												1.1048	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2032 (42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249	(42a)

Hot water usage for baths

26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)

Hot water usage for other uses

37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)

Average daily hot water use (litres/day) 114.6970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)
Energy content (annual)										Total = Sum(45)m =		1905.0938	
Distribution loss (46)m = 0.15 x (45)m	29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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	248.5726	219.9124	233.6531	205.2838	198.9412	179.1862	176.6938	183.6873	185.6970	207.1796	220.4664	245.8203	(62)
WWHRS	-27.9594	-24.7276	-25.8933	-21.4407	-19.9819	-17.0987	-16.0273	-17.0434	-17.6909	-20.8557	-23.6270	-27.4417	(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	220.6132	195.1849	207.7598	183.8431	178.9593	162.0875	160.6665	166.6439	168.0061	186.3240	196.8394	218.3786	(64)
									Total per year (kWh/year) = Sum(64)m =			2245.3063	(64)
12Total per year (kWh/year)												2245	(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	78.4463	69.3236	73.4855	64.1884	61.9438	55.5109	54.5466	56.8719	57.6758	64.6831	69.2366	77.5311	(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	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	100.1914	110.9262	100.1914	103.5311	100.1914	103.5311	100.1914	100.1914	103.5311	100.1914	103.5311	100.1914	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	193.2024	195.2072	190.1551	179.3998	165.8230	153.0628	144.5382	142.5334	147.5855	158.3409	171.9176	184.6778	(68)

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

	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	(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)												
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260 (71)
Water heating gains (Table 5)												
	105.4386	103.1602	98.7709	89.1505	83.2579	77.0985	73.3153	76.4408	80.1052	86.9397	96.1619	104.2085 (72)
Total internal gains												
	457.8796	468.3409	448.1647	431.1286	408.3195	389.7397	374.0922	375.2128	387.2691	404.5192	430.6579	448.1250 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1400	10.6334	0.6300	0.7000	0.7700	13.4538	(74)
South	6.9700	46.7521	0.6300	0.7000	0.7700	99.5876	(78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	117.2430	197.0290	264.9840	324.7300	363.4165	361.4476	348.1411	318.6528	285.3001	216.2757	139.8812	100.7238	(83)
Total gains	575.1227	665.3698	713.1487	755.8586	771.7360	751.1872	722.2333	693.8657	672.5692	620.7949	570.5391	548.8488	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6082	54.7307	54.8514	55.4254	55.5341	56.0459	56.0459	56.1417	55.8477	55.5341	55.3146	55.0869	
alpha	4.6405	4.6487	4.6568	4.6950	4.7023	4.7364	4.7364	4.7428	4.7232	4.7023	4.6876	4.6725	
util living area													
	0.9863	0.9727	0.9496	0.8922	0.7822	0.6062	0.4484	0.4847	0.7022	0.9052	0.9730	0.9888	(86)
MIT	19.7611	19.9848	20.2540	20.5837	20.8314	20.9615	20.9924	20.9891	20.9227	20.6137	20.1346	19.7220	(87)
Th 2	19.9834	19.9855	19.9875	19.9969	19.9986	20.0069	20.0069	20.0084	20.0037	19.9986	19.9951	19.9913	(88)
util rest of house													
	0.9826	0.9655	0.9361	0.8636	0.7279	0.5234	0.3502	0.3845	0.6229	0.8739	0.9646	0.9857	(89)
MIT 2	18.5629	18.8453	19.1813	19.5838	19.8576	19.9842	20.0042	20.0043	19.9522	19.6285	19.0441	18.5191	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	18.9073	19.1729	19.4896	19.8712	20.1375	20.2651	20.2883	20.2873	20.2312	19.9117	19.3576	18.8648	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9073	19.1729	19.4896	19.8712	20.1375	20.2651	20.2883	20.2873	20.2312	19.9117	19.3576	18.8648	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9582	0.9280	0.8595	0.7361	0.5457	0.3784	0.4133	0.6422	0.8707	0.9577	0.9810	(94)
Useful gains	562.0445	637.5336	661.8128	649.6687	568.0397	409.9386	273.3108	286.7451	431.9039	540.5086	546.4046	538.4257	(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													
	1118.1239	1090.0760	989.8847	827.4162	635.0820	422.5134	275.0783	289.4305	458.8960	700.8816	926.2800	1112.7689	(97)
Space heating kWh													
	413.7230	304.1085	244.0855	127.9782	49.8794	0.0000	0.0000	0.0000	0.0000	119.3175	273.5103	427.3114	(98a)
Space heating requirement - total per year (kWh/year)												1959.9138	
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													
	413.7230	304.1085	244.0855	127.9782	49.8794	0.0000	0.0000	0.0000	0.0000	119.3175	273.5103	427.3114	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1959.9138	
Space heating per m2											(98c) / (4) =	28.7125	(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													
	413.7230	304.1085	244.0855	127.9782	49.8794	0.0000	0.0000	0.0000	0.0000	119.3175	273.5103	427.3114	(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)													
	447.7522	329.1218	264.1617	138.5046	53.9821	0.0000	0.0000	0.0000	0.0000	129.1314	296.0068	462.4582	(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													
	220.6132	195.1849	207.7598	183.8431	178.9593	162.0875	160.6665	166.6439	168.0061	186.3240	196.8394	218.3786	(64)
Efficiency of water heater												80.3000	(216)
(217)m	85.7076	85.3276	84.7277	83.6200	82.0297	80.3000	80.3000	80.3000	80.3000	83.4515	85.0864	85.7925	(217)
Fuel for water heating, kWh/month													
	257.4021	228.7477	245.2090	219.8555	218.1641	201.8525	200.0828	207.5267	209.2230	223.2721	231.3406	254.5429	(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	20.8178	16.7008	15.0372	11.0169	8.5098	6.9526	7.7629	10.0905	13.1066	17.1966	19.4235	21.3964	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-32.1021	-45.3458	-65.3154	-73.6109	-79.5414	-74.3235	-73.4218	-69.2403	-61.8728	-51.9453	-35.3301	-27.7453	(233a)

Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-17.8709	-37.6258	-74.8357	-112.4669	-148.7660	-149.4783	-147.7026	-125.0202	-91.5956	-53.8125	-23.8635	-14.1281	(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	2121.1188	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	80.3000	
Water heating fuel used	2697.2188	(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)	168.0115	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1686.9608	(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	3385.3884	(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	2121.1188	0.2100	445.4350	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2697.2188	0.2100	566.4160	(264)
Space and water heating			1011.8509	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	168.0115	0.1443	24.2493	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-689.7948	0.1345	-92.8010	
PV Unit electricity exported	-997.1660	0.1259	-125.5241	
Total			-218.3251	(269)
Total CO2, kg/year			829.7043	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			12.1600	(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	2121.1188	1.1300	2396.8643	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2697.2188	1.1300	3047.8573	(278)
Space and water heating			5444.7216	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	168.0115	1.5338	257.7017	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-689.7948	1.4972	-1032.7695	
PV Unit electricity exported	-997.1660	0.4621	-460.7594	
Total			-1493.5289	(283)
Total Primary energy kWh/year			4338.9952	(286)
Target Primary Energy Rate (TPER)			63.5700	(287)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		34.1300 (1b)	x	2.3100 (2b)	=	78.8403	(1b) - (3b)
First floor		34.1300 (1c)	x	2.5500 (2c)	=	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	165.8718	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)

Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	2 * 10 =	20.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1206 (8)
Pressure test		Yes
Pressure Test Method		Blower Door
Measured/design AP50		4.0000 (17)
Infiltration rate		0.3206 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2725 (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	0.3474	0.3406	0.3338	0.2997	0.2929	0.2589	0.2589	0.2521	0.2725	0.2929	0.3065	0.3202	(22b)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5604	0.5580	0.5557	0.5449	0.5429	0.5335	0.5335	0.5318	0.5371	0.5429	0.5470	0.5513	(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	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15048.0301 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		220.4517 (35)

List of Thermal Bridges

	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3 Sill	5.8300	0.0310	0.1807
E4 Jamb	24.7500	0.0360	0.8910
E5 Ground floor (normal)	16.6300	0.0590	0.9812
E6 Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12 Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10 Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16 Corner (normal)	9.7200	0.0520	0.5054
E18 Party wall between dwellings	9.7200	0.0530	0.5152
P1 Party wall - Ground floor	7.3900	0.0860	0.6355
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.7731 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	45.1326 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.6723	30.5441	30.4183	29.8277	29.7172	29.2029	29.2029	29.1076	29.4010	29.7172	29.9408	30.1745	(38)
Heat transfer coeff	75.8050	75.6767	75.5509	74.9604	74.8499	74.3355	74.3355	74.2402	74.5336	74.8499	75.0734	75.3071	(39)

Average = Sum(39)m / 12 =	74.9598

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1105	1.1087	1.1068	1.0982	1.0965	1.0890	1.0890	1.0876	1.0919	1.0965	1.0998	1.1032	(40)
HLP (average)												1.0982	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.2032 (42)

Hot water usage for mixer showers

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

Hot water usage for baths

26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)

Hot water usage for other uses

37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)

Average daily hot water use (litres/day)	58.3103 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	63.6162	61.8713	59.9662	57.5948	55.4794	53.2809	52.8240	54.7252	56.6751	58.9328	61.3252	63.5268	(44)
Energy conte	100.7525	88.1039	92.1658	78.8444	74.6859	65.5151	63.8860	67.7612	69.8861	79.9713	87.3690	99.4677	(45)

Energy content (annual)	Total = Sum(45)m =	968.4090

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)

Water storage loss:

Total storage loss

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

	85.6396	74.8883	78.3410	67.0178	63.4830	55.6879	54.3031	57.5970	59.4032	67.9756	74.2637	84.5475	(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													
	85.6396	74.8883	78.3410	67.0178	63.4830	55.6879	54.3031	57.5970	59.4032	67.9756	74.2637	84.5475	(64)
										Total per year (kWh/year) = Sum(64)m =		823.1476	(64)
12Total per year (kWh/year)												823	(64)
Electric shower(s)													
	48.9784	43.6401	47.6533	45.4750	46.3283	44.1927	45.6658	46.3283	45.4750	47.6533	46.7573	48.9784	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						557.1259	(64a)
Heat gains from water heating, kWh/month													
	33.6545	29.6321	31.4986	28.1232	27.4528	24.9701	24.9922	25.9813	26.2195	28.9072	30.2552	33.3815	(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	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	100.1914	110.9262	100.1914	103.5311	100.1914	103.5311	100.1914	100.1914	103.5311	100.1914	103.5311	100.1914	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	193.2024	195.2072	190.1551	179.3998	165.8230	153.0628	144.5382	142.5334	147.5855	158.3409	171.9176	184.6778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	(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)													
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)													
	45.2345	44.0954	42.3368	39.0600	36.8990	34.6808	33.5917	34.9211	36.4160	38.8538	42.0212	44.8676	(72)
Total internal gains													
	394.6756	406.2761	388.7306	378.0381	358.9607	347.3219	334.3686	333.6932	343.5799	353.4333	373.5171	385.7840	(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	
South	5.1200	46.7521	0.7300	0.7000	0.7700	84.7666	(78)
North	4.1400	10.6334	0.7300	0.7000	0.7700	15.5893	(74)
South	1.8500	46.7521	0.7300	0.7000	0.7700	30.6286	(78)
West	0.7000	19.6403	0.7300	0.7000	0.7700	4.8685	(80)

Solar gains	135.8530	228.3034	307.0450	376.2744	421.1016	418.8202	403.4016	369.2327	330.5858	250.6052	162.0846	116.7117	(83)
Total gains	530.5286	634.5795	695.7755	754.3125	780.0623	766.1421	737.7702	702.9258	674.1657	604.0385	535.6017	502.4958	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.1416	55.2351	55.3270	55.7629	55.8452	56.2317	56.2317	56.3038	56.0822	55.8452	55.6790	55.5062	
alpha	4.6761	4.6823	4.6885	4.7175	4.7230	4.7488	4.7488	4.7536	4.7388	4.7230	4.7119	4.7004	
util living area													
	0.9900	0.9768	0.9530	0.8917	0.7752	0.5948	0.4381	0.4776	0.6992	0.9117	0.9785	0.9921	(86)
MIT	19.7066	19.9545	20.2444	20.5897	20.8400	20.9648	20.9932	20.9899	20.9248	20.6012	20.0910	19.6594	(87)
Th 2	19.9922	19.9938	19.9953	20.0023	20.0037	20.0098	20.0098	20.0110	20.0074	20.0037	20.0010	19.9982	(88)
util rest of house													
	0.9872	0.9706	0.9403	0.8631	0.7207	0.5129	0.3421	0.3790	0.6202	0.8819	0.9716	0.9899	(89)
MIT 2	18.8296	19.0744	19.3568	19.6851	19.8997	19.9937	20.0080	20.0080	19.9685	19.7040	19.2168	18.7875	(90)
Living area fraction										fLA = Living area / (4) =		0.2874	(91)
MIT	19.0817	19.3274	19.6119	19.9451	20.1700	20.2728	20.2912	20.2902	20.2434	19.9619	19.4681	19.0381	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0817	19.3274	19.6119	19.9451	20.1700	20.2728	20.2912	20.2902	20.2434	19.9619	19.4681	19.0381	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9838	0.9654	0.9344	0.8612	0.7305	0.5354	0.3698	0.4073	0.6401	0.8805	0.9669	0.9870	(94)
Useful gains	521.9380	612.6321	650.1445	649.6074	569.8009	410.1950	272.8080	286.3144	431.5389	531.8352	517.8756	495.9661	(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													
	1120.5253	1091.8161	990.6187	827.9449	633.9755	421.6939	274.3855	288.8097	457.8889	700.7343	928.5143	1117.4168	(97)
Space heating kWh													
	445.3489	322.0116	253.3128	128.4030	47.7459	0.0000	0.0000	0.0000	0.0000	125.6609	295.6599	462.3594	(98a)
Space heating requirement - total per year (kWh/year)												2080.5025	
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													
	445.3489	322.0116	253.3128	128.4030	47.7459	0.0000	0.0000	0.0000	0.0000	125.6609	295.6599	462.3594	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2080.5025	
Space heating per m2											(98c) / (4) =	30.4791	(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	698.7534	550.0825	564.2256	0.0000	0.0000	0.0000	0.0000	(100)

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8982	0.9461	0.9315	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	627.6396	520.4275	525.5599	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	855.9142	824.7862	786.0258	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	164.3577	226.4429	193.7866	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	41.0894	56.6107	48.4467	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												146.1468	(107)
Energy for space heating												30.4791	(99)
Energy for space cooling												2.1410	(108)
Total												32.6201	(109)
Fabric Energy Efficiency (DFEE)												32.6	(109)

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

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1. Overall dwelling characteristics

		Area (m2)		Storey height (m)		Volume (m3)	
Ground floor		34.1300 (1b)	x	2.3100 (2b)	=	78.8403	(1b) - (3b)
First floor		34.1300 (1c)	x	2.5500 (2c)	=	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	165.8718	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	2 * 10 =	20.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1206	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3706	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3150	(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													
	0.4016	0.3937	0.3859	0.3465	0.3386	0.2992	0.2992	0.2914	0.3150	0.3386	0.3544	0.3701	(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	0.5806	0.5775	0.5744	0.5600	0.5573	0.5448	0.5448	0.5424	0.5496	0.5573	0.5628	0.5685	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.4900	1.0000	2.4900			(26)
TER Opening Type (Uw = 1.20)			11.8100	1.1450	13.5229			(27)
B&B 225mm TE Platinum GF			34.1300	0.1300	4.4369			(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.1800	11.9682			(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.1100	3.7543			(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		36.1723			(33)
E-WM-22			35.9300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		220.4517	(35)
List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	9.3400	0.0500	0.4670
E3 Sill	5.8300	0.0500	0.2915
E4 Jamb	24.7500	0.0500	1.2375
E5 Ground floor (normal)	16.6300	0.1600	2.6608
E6 Intermediate floor within a dwelling	16.6300	0.0000	0.0000
E12 Gable (insulation at ceiling level)	9.2300	0.0600	0.5538
E10 Eaves (insulation at ceiling level)	7.3900	0.0600	0.4434
E16 Corner (normal)	9.7200	0.0900	0.8748
E18 Party wall between dwellings	9.7200	0.0600	0.5832
P1 Party wall - Ground floor	7.3900	0.0800	0.5912
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.1200	0.8868
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		8.5900	(36)

Point Thermal bridges											(36a) =	0.0000	
Total fabric heat loss										(33) + (36) + (36a) =		44.7623	(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	31.7832	31.6118	31.4438	30.6546	30.5069	29.8196	29.8196	29.6923	30.0843	30.5069	30.8056	31.1179	(38)
Heat transfer coeff													
	76.5455	76.3741	76.2061	75.4169	75.2692	74.5819	74.5819	74.4546	74.8466	75.2692	75.5679	75.8802	(39)
Average = Sum(39)m / 12 =												75.4162	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1214	1.1189	1.1164	1.1048	1.1027	1.0926	1.0926	1.0907	1.0965	1.1027	1.1071	1.1116	(40)
HLP (average)												1.1048	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2032	(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													
	26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)
Hot water usage for other uses													
	37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)
Average daily hot water use (litres/day)												58.3103	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	63.6162	61.8713	59.9662	57.5948	55.4794	53.2809	52.8240	54.7252	56.6751	58.9328	61.3252	63.5268	(44)
Energy conte	100.7525	88.1039	92.1658	78.8444	74.6859	65.5151	63.8860	67.7612	69.8861	79.9713	87.3690	99.4677	(45)
Energy content (annual)										Total = Sum(45)m =		968.4090	
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													
	85.6396	74.8883	78.3410	67.0178	63.4830	55.6879	54.3031	57.5970	59.4032	67.9756	74.2637	84.5475	(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													
	85.6396	74.8883	78.3410	67.0178	63.4830	55.6879	54.3031	57.5970	59.4032	67.9756	74.2637	84.5475	(64)
										Total per year (kWh/year) = Sum(64)m =		823.1476	(64)
12Total per year (kWh/year)												823	(64)
Electric shower(s)													
	48.9784	43.6401	47.6533	45.4750	46.3283	44.1927	45.6658	46.3283	45.4750	47.6533	46.7573	48.9784	(64a)
						Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =						557.1259	(64a)
Heat gains from water heating, kWh/month													
	33.6545	29.6321	31.4986	28.1232	27.4528	24.9701	24.9922	25.9813	26.2195	28.9072	30.2552	33.3815	(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	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	110.1576	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	100.1914	110.9262	100.1914	103.5311	100.1914	103.5311	100.1914	100.1914	103.5311	100.1914	103.5311	100.1914	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	193.2024	195.2072	190.1551	179.3998	165.8230	153.0628	144.5382	142.5334	147.5855	158.3409	171.9176	184.6778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	34.0158	(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)													
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)													
	45.2345	44.0954	42.3368	39.0600	36.8990	34.6808	33.5917	34.9211	36.4160	38.8538	42.0212	44.8676	(72)
Total internal gains													
	394.6756	406.2761	388.7306	378.0381	358.9607	347.3219	334.3686	333.6932	343.5799	353.4333	373.5171	385.7840	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1400	10.6334	0.6300	0.7000	0.7700	13.4538	(74)
South	6.9700	46.7521	0.6300	0.7000	0.7700	99.5876	(78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	117.2430	197.0290	264.9840	324.7300	363.4165	361.4476	348.1411	318.6528	285.3001	216.2757	139.8812	100.7238	(83)
Total gains	511.9186	603.3051	653.7146	702.7681	722.3771	708.7695	682.5097	652.3460	628.8800	569.7090	513.3983	486.5079	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.6082	54.7307	54.8514	55.4254	55.5341	56.0459	56.0459	56.1417	55.8477	55.5341	55.3146	55.0869	
alpha	4.6405	4.6487	4.6568	4.6950	4.7023	4.7364	4.7364	4.7428	4.7232	4.7023	4.6876	4.6725	
util living area													
	0.9914	0.9811	0.9626	0.9129	0.8114	0.6357	0.4729	0.5130	0.7356	0.9270	0.9819	0.9931	(86)

MIT	19.6570	19.8883	20.1704	20.5263	20.8009	20.9532	20.9906	20.9862	20.9057	20.5546	20.0454	19.6180	(87)
Th 2	19.9834	19.9855	19.9875	19.9969	19.9986	20.0069	20.0069	20.0084	20.0037	19.9986	19.9951	19.9913	(88)
util rest of house	0.9889	0.9758	0.9520	0.8880	0.7599	0.5513	0.3701	0.4082	0.6571	0.9008	0.9759	0.9911	(89)
MIT 2	18.7738	19.0033	19.2803	19.6248	19.8662	19.9849	20.0043	20.0042	19.9536	19.6589	19.1678	18.7413	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	19.0277	19.2577	19.5361	19.8839	20.1349	20.2632	20.2878	20.2865	20.2273	19.9164	19.4201	18.9933	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0277	19.2577	19.5361	19.8839	20.1349	20.2632	20.2878	20.2865	20.2273	19.9164	19.4201	18.9933	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9858	0.9710	0.9463	0.8848	0.7676	0.5741	0.3997	0.4383	0.6761	0.8982	0.9715	0.9885	(94)
Useful gains	504.6679	585.8315	618.5793	621.7828	554.4668	406.8765	272.8100	285.9272	425.1700	511.7410	498.7599	480.9158	(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	1127.3378	1096.5556	993.4330	828.3726	634.8868	422.3743	275.0397	289.3676	458.6046	701.2365	931.0022	1122.5185	(97)
Space heating kWh	463.2664	343.2065	278.8911	148.7447	59.8325	0.0000	0.0000	0.0000	0.0000	140.9847	311.2145	477.3525	(98a)
Space heating requirement - total per year (kWh/year)												2223.4929	
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	463.2664	343.2065	278.8911	148.7447	59.8325	0.0000	0.0000	0.0000	0.0000	140.9847	311.2145	477.3525	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2223.4929	
Space heating per m2											(98c) / (4) =	32.5739	(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	701.0696	551.9058	565.8548	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8706	0.9285	0.9114	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	610.3335	512.4296	515.7406	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	788.8553	760.1960	726.9065	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	128.5357	184.3383	157.1075	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	32.1339	46.0846	39.2769	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												117.4954	(107)
Energy for space heating												32.5739	(99)
Energy for space cooling												1.7213	(108)
Total												34.2952	(109)
Fabric Energy Efficiency (TFEE)												34.3	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	34.1300	(1b)	x 2.3100	(2b) =	78.8403	(1b) - (3b)
First floor	34.1300	(1c)	x 2.5500	(2c) =	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		165.8718	(5)

2. Ventilation rate

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

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

Mechanical extract ventilation - decentralised

If mechanical ventilation 0.5000 (23a)

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15048.0301 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.4517 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3 Sill	5.8300	0.0310	0.1807
E4 Jamb	24.7500	0.0360	0.8910
E5 Ground floor (normal)	16.6300	0.0590	0.9812
E6 Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12 Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10 Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16 Corner (normal)	9.7200	0.0520	0.5054
E18 Party wall between dwellings	9.7200	0.0530	0.5152
P1 Party wall - Ground floor	7.3900	0.0860	0.6355
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.7731 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 45.1326 (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	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	(38)
Heat transfer coeff	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	(39)

Average = Sum(39)m / 12 = 72.5015

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	(40)
HLP (average)												1.0621	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2032 (42)

Hot water usage for mixer showers

61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249	(42a)

Hot water usage for baths

26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)

Hot water usage for other uses

37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)

Average daily hot water use (litres/day) 114.6970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)

Energy content (annual) Total = Sum(45)m = 1905.0938

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

29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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 5.4547	4.9177	5.4249	5.2082	5.3555	5.1560	5.3110	5.3250	5.1691	5.3720	5.2386	5.4492	(61)

Total heat required for water heating calculated for each month

203.0685	178.8027	188.1191	161.1770	153.3378	135.0272	131.0458	138.0534	141.5510	161.5927	176.3899	200.3106	(62)
WWHRS -54.4610	-48.1658	-50.4364	-41.7633	-38.9219	-33.3058	-31.2189	-33.1981	-34.4594	-40.6239	-46.0219	-53.4525	(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

148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)

Total per year (kWh/year) = Sum(64)m = 1462.4467 (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

67.0703	59.0462	62.1020	53.1617	50.5430	44.4712	43.1346	45.4634	46.6393	53.2864	58.2175	66.1537	(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	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0493	19.5840	15.9268	12.0576	9.0132	7.6093	8.2221	10.6874	14.3447	18.2139	21.2583	22.6621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.3618	291.3541	283.8136	267.7608	247.4971	228.4520	215.7287	212.7364	220.2769	236.3297	256.5934	275.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	(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)													
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)													
	90.1482	87.8663	83.4705	73.8356	67.9341	61.7655	57.9766	61.1068	64.7768	71.6215	80.8576	88.9163	(72)
Total internal gains													
	498.0444	496.2895	480.6960	451.1391	421.9294	392.3119	376.4125	379.0157	393.8834	423.6501	456.1944	484.7020	(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	
South	5.1200	46.7521	0.7300	0.7000	0.7700	84.7666	(78)
North	4.1400	10.6334	0.7300	0.7000	0.7700	15.5893	(74)
South	1.8500	46.7521	0.7300	0.7000	0.7700	30.6286	(78)
West	0.7000	19.6403	0.7300	0.7000	0.7700	4.8685	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	135.8530	228.3034	307.0450	376.2744	421.1016	418.8202	403.4016	369.2327	330.5858	250.6052	162.0846	116.7117	(83)
Total gains	633.8974	724.5930	787.7409	827.4135	843.0311	811.1320	779.8141	748.2484	724.4692	674.2552	618.2789	601.4137	(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	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	
alpha	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	
util living area													
	0.9788	0.9599	0.9240	0.8522	0.7254	0.5550	0.4059	0.4407	0.6504	0.8717	0.9615	0.9831	(86)
MIT	19.9590	20.1681	20.4297	20.6964	20.8893	20.9757	20.9956	20.9934	20.9487	20.7068	20.2712	19.8948	(87)
Th 2	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	(88)
util rest of house													
	0.9733	0.9500	0.9058	0.8184	0.6694	0.4779	0.3182	0.3505	0.5734	0.8347	0.9503	0.9787	(89)
MIT 2	18.8471	19.1071	19.4265	19.7379	19.9419	20.0178	20.0304	20.0294	19.9987	19.7580	19.2399	18.7665	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	19.1667	19.4121	19.7148	20.0134	20.2143	20.2931	20.3078	20.3065	20.2717	20.0307	19.5363	19.0908	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0167	19.2621	19.5648	19.8634	20.0643	20.1431	20.1578	20.1565	20.1217	19.8807	19.3863	18.9408	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9658	0.9403	0.8955	0.8118	0.6714	0.4870	0.3297	0.3622	0.5809	0.8280	0.9408	0.9720	(94)
Useful gains	612.2034	681.3385	705.4020	671.7131	566.0127	395.0149	257.1315	271.0523	420.8436	558.2936	581.6873	584.5927	(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													
	1066.9810	1041.2704	947.2206	794.8621	606.4205	401.8852	257.9454	272.3520	436.5844	672.8633	890.7746	1068.7285	(97)
Space heating kWh													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98a)
Space heating requirement - total per year (kWh/year)												1546.8522	
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													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1546.8522	
Space heating per m2											(98c) / (4) =	22.6612	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	380.1736	271.7688	202.1495	99.6261	33.7791	0.0000	0.0000	0.0000	0.0000	95.7751	250.0482	404.7158	(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

	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4742	88.3963	88.2550	88.0164	87.6484	87.3000	87.3000	87.3000	87.3000	87.9948	88.3644	88.5009	(217)
Fuel for water heating, kWh/month													
	167.9670	147.7854	156.0056	135.6720	130.5396	116.5194	114.3494	120.1091	122.6708	137.4727	147.5346	165.9398	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.5311	8.6087	9.5311	9.2236	9.5311	9.2236	9.5311	9.5311	9.2236	9.5311	9.2236	9.5311	(231)
Lighting	19.2996	15.4829	13.9406	10.2135	7.8892	6.4455	7.1968	9.3547	12.1508	15.9425	18.0070	19.8360	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6969	-24.3299	-35.9017	-41.7594	-46.5817	-44.0826	-43.6637	-40.5567	-35.4268	-28.5857	-18.7083	-14.3823	(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	-5.6885	-11.7532	-22.5350	-32.7705	-42.6407	-42.5752	-42.2897	-36.3608	-27.4742	-16.6867	-7.5846	-4.5303	(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	1738.0362	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1662.5653	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.4420, total flow = 42.0000, SFP = 0.1296)		
mechanical ventilation fans (SFP = 0.1296)	26.2205	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.2205	(231)
Electricity for lighting (calculated in Appendix L)	155.7591	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.5651	(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	2985.0160	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1738.0362	3.6400	63.2645	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.5653	3.6400	60.5174	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	112.2205	16.4900	18.5052	(249)
Energy for lighting	155.7591	16.4900	25.6847	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	16.4900	-64.4224	
PV Unit electricity exported	-292.8894	5.5900	-16.3725	
Total			-80.7949	(252)
Total energy cost			179.1768	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.3600	(256)
Energy cost factor (ECF) [(255) x (256)] / [(4) + 45.0] =	0.5695	(257)
SAP value	90.7681	
SAP rating (Section 12)	91	(258)
SAP band	B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1738.0362	0.2100	364.9876	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1662.5653	0.2100	349.1387	(264)
Space and water heating			714.1263	(265)
Pumps, fans and electric keep-hot	112.2205	0.1387	15.5664	(267)
Energy for lighting	155.7591	0.1443	22.4809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	0.1338	-52.2856	
PV Unit electricity exported	-292.8894	0.1266	-37.0906	
Total			-89.3762	(269)
Total CO2, kg/year			662.7973	(272)
CO2 emissions per m2			9.7100	(273)
EI value			92.1583	
EI rating			92	(274)
EI band			A	

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	34.1300	(1b)	x 2.3100	(2b)	= 78.8403	(1b) - (3b)
First floor	34.1300	(1c)	x 2.5500	(2c)	= 87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 165.8718	(5)

2. Ventilation rate

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.1998	0.1955	0.1913	0.1742	0.1700	0.1488	0.1445	0.1445	0.1573	0.1700	0.1700	0.1827	(22b)

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	15048.0301 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		220.4517 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3 Sill	5.8300	0.0310	0.1807
E4 Jamb	24.7500	0.0360	0.8910
E5 Ground floor (normal)	16.6300	0.0590	0.9812
E6 Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12 Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10 Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16 Corner (normal)	9.7200	0.0520	0.5054
E18 Party wall between dwellings	9.7200	0.0530	0.5152
P1 Party wall - Ground floor	7.3900	0.0860	0.6355
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		5.7731 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	45.1326 (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	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	(38)
Heat transfer coeff	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	(39)
Average = Sum(39)m / 12 =												72.5015	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	(40)
HLP (average)												1.0621	

Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2032	(42)
Hot water usage for mixer showers													
	61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249	(42a)
Hot water usage for baths													
	26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)
Hot water usage for other uses													
	37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)
Average daily hot water use (litres/day)												114.6970	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)
Energy content (annual)											Total = Sum(45)m =	1905.0938	
Distribution loss (46)m = 0.15 x (45)m													
	29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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	5.4547	4.9177	5.4249	5.2082	5.3555	5.1560	5.3110	5.3250	5.1691	5.3720	5.2386	5.4492	(61)
Total heat required for water heating calculated for each month													
	203.0685	178.8027	188.1191	161.1770	153.3378	135.0272	131.0458	138.0534	141.5510	161.5927	176.3899	200.3106	(62)
WWHRS	-54.4610	-48.1658	-50.4364	-41.7633	-38.9219	-33.3058	-31.2189	-33.1981	-34.4594	-40.6239	-46.0219	-53.4525	(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													
	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
										Total per year (kWh/year) = Sum(64)m =		1462.4467	(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													
	67.0703	59.0462	62.1020	53.1617	50.5430	44.4712	43.1346	45.4634	46.6393	53.2864	58.2175	66.1537	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0493	19.5840	15.9268	12.0576	9.0132	7.6093	8.2221	10.6874	14.3447	18.2139	21.2583	22.6621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.3618	291.3541	283.8136	267.7608	247.4971	228.4520	215.7287	212.7364	220.2769	236.3297	256.5934	275.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	(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)													
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)													
	90.1482	87.8663	83.4705	73.8356	67.9341	61.7655	57.9766	61.1068	64.7768	71.6215	80.8576	88.9163	(72)
Total internal gains													
	498.0444	496.2895	480.6960	451.1391	421.9294	392.3119	376.4125	379.0157	393.8834	423.6501	456.1944	484.7020	(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	
South	5.1200	53.3164	0.7300	0.7000	0.7700	96.6685	(78)
North	4.1400	12.4405	0.7300	0.7000	0.7700	18.2387	(74)
South	1.8500	53.3164	0.7300	0.7000	0.7700	34.9290	(78)
West	0.7000	23.1469	0.7300	0.7000	0.7700	5.7378	(80)

Solar gains	155.5740	231.6199	308.8029	386.1959	422.4552	448.2949	420.4300	388.7090	348.0684	263.0687	179.2650	128.1271	(83)
Total gains	653.6184	727.9094	789.4988	837.3350	844.3846	840.6068	796.8425	767.7247	741.9517	686.7188	635.4594	612.8291	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	
alpha	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	
util living area													
	0.9767	0.9610	0.9251	0.8476	0.7191	0.5224	0.3887	0.4121	0.6381	0.8652	0.9586	0.9827	(86)
MIT	19.9778	20.1496	20.4213	20.7045	20.8946	20.9817	20.9964	20.9953	20.9527	20.7181	20.2843	19.8885	(87)
Th 2	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	(88)
util rest of house													
	0.9708	0.9515	0.9073	0.8133	0.6624	0.4459	0.3025	0.3232	0.5615	0.8271	0.9468	0.9782	(89)
MIT 2	18.8703	19.0838	19.4163	19.7465	19.9470	20.0218	20.0307	20.0302	20.0015	19.7698	19.2554	18.7582	(90)
Living area fraction										fLA = Living area / (4) =		0.2874	(91)
MIT	19.1887	19.3902	19.7052	20.0219	20.2193	20.2977	20.3083	20.3076	20.2749	20.0423	19.5511	19.0831	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0387	19.2402	19.5552	19.8719	20.0693	20.1477	20.1583	20.1576	20.1249	19.8923	19.4011	18.9331	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9629	0.9418	0.8969	0.8069	0.6647	0.4553	0.3139	0.3348	0.5692	0.8209	0.9371	0.9714	(94)
Useful gains	629.3441	685.5757	708.0942	675.6844	561.2656	382.7418	250.0945	257.0627	422.3545	563.6931	595.5069	595.3080	(95)
Ext temp.	4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W	1075.8240	1054.1823	953.7687	795.4786	599.5381	387.7172	250.7303	257.9337	436.8123	673.7088	899.0990	1082.6713	(97)
Space heating kWh	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98a)
Space heating requirement - total per year (kWh/year)												1540.4294	
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	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1540.4294	
Space heating per m2											(98c) / (4) =	22.5671	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	373.2371	278.3187	205.3728	96.9122	31.9941	0.0000	0.0000	0.0000	0.0000	91.9681	245.6026	407.4139	(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	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4675	88.4056	88.2616	88.0050	87.6336	87.3000	87.3000	87.3000	87.3000	87.9782	88.3572	88.5032	(217)
Fuel for water heating, kWh/month	167.9797	147.7700	155.9939	135.6896	130.5617	116.5194	114.3494	120.1091	122.6708	137.4986	147.5466	165.9354	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.5311	8.6087	9.5311	9.2236	9.5311	9.2236	9.5311	9.5311	9.2236	9.5311	9.2236	9.5311	(231)
Lighting	19.2996	15.4829	13.9406	10.2135	7.8892	6.4455	7.1968	9.3547	12.1508	15.9425	18.0070	19.8360	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.8984	-24.8413	-36.3473	-42.7457	-46.7963	-46.1336	-44.9344	-42.1342	-36.9803	-29.9248	-20.5120	-15.7241	(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	-7.0234	-12.1957	-23.0584	-34.3062	-43.0428	-46.8208	-44.8974	-39.3042	-29.8861	-18.1532	-8.9001	-5.2648	(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	1730.8196	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1662.6241	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.4420, total flow = 42.0000, SFP = 0.1296)		
mechanical ventilation fans (SFP = 0.1296)	26.2205	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.2205	(231)
Electricity for lighting (calculated in Appendix L)	155.7591	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-718.8257	(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	2942.5975	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1730.8196	6.1900	107.1377	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.6241	6.1900	102.9164	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	112.2205	25.1600	28.2347	(249)
Energy for lighting	155.7591	25.1600	39.1890	(250)

Additional standing charges			102.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-405.9725	25.1600	-102.1427
PV Unit electricity exported	-312.8532	5.8100	-18.1768
Total			-120.3195 (252)
Total energy cost			259.1584 (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	1730.8196	0.2100	363.4721	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1662.6241	0.2100	349.1511	(264)
Space and water heating			712.6232	(265)
Pumps, fans and electric keep-hot	112.2205	0.1387	15.5664	(267)
Energy for lighting	155.7591	0.1443	22.4809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-405.9725	0.1340	-54.3904	
PV Unit electricity exported	-312.8532	0.1266	-39.6131	
Total			-94.0036	(269)
Total CO2, kg/year			656.6668	(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	1730.8196	1.1300	1955.8261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.6241	1.1300	1878.7652	(278)
Space and water heating			3834.5913	(279)
Pumps, fans and electric keep-hot	112.2205	1.5128	169.7672	(281)
Energy for lighting	155.7591	1.5338	238.9085	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-405.9725	1.4951	-606.9693	
PV Unit electricity exported	-312.8532	0.4647	-145.3979	
Total			-752.3672	(283)
Total Primary energy kWh/year			3490.8998	(286)

SAP 10 EPC IMPROVEMENTS

1

Current energy efficiency rating: B 91
Current environmental impact rating: A 92

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

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

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.5	-£ 20	-122 kg (18.5%)

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

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£67	£67	£0
Mains gas	£312	£312	£0
Space heating	£237	£237	£0
Water heating	£103	£103	£0
Lighting	£39	£39	£0
Generated (PV)	-£120	-£120	£0
Total cost of fuels	£259	£259	£0
Total cost of uses	£259	£259	£0
Delivered energy	43 kWh/m²	43 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	51 kWh/m²	51 kWh/m²	0 kWh/m²

CALCULATION OF ENERGY RATING FOR IMPROVED DWELLING

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	34.1300 (1b)	x	2.3100 (2b)	=	78.8403	(1b) - (3b)
First floor	34.1300 (1c)	x	2.5500 (2c)	=	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	165.8718	(5)

2. Ventilation rate

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

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

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) = 15048.0301	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	220.4517	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3 Sill	5.8300	0.0310	0.1807
E4 Jamb	24.7500	0.0360	0.8910
E5 Ground floor (normal)	16.6300	0.0590	0.9812
E6 Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12 Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10 Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16 Corner (normal)	9.7200	0.0520	0.5054
E18 Party wall between dwellings	9.7200	0.0530	0.5152
P1 Party wall - Ground floor	7.3900	0.0860	0.6355
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.7731	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 45.1326	(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	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	(38)
Heat transfer coeff	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	(39)
Average = Sum(39)m / 12 =												72.5015	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	(40)
HLP (average)												1.0621	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2032 (42)

Hot water usage for mixer showers

	61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249 (42a)

Hot water usage for baths

	26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344 (42b)

Hot water usage for other uses

	37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925 (42c)

Average daily hot water use (litres/day) 114.6970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)
Energy content (annual)										Total = Sum(45)m =		1905.0938	
Distribution loss (46)m = 0.15 x (45)m													
	29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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	5.4547	4.9177	5.4249	5.2082	5.3555	5.1560	5.3110	5.3250	5.1691	5.3720	5.2386	5.4492	(61)
Total heat required for water heating calculated for each month													
	203.0685	178.8027	188.1191	161.1770	153.3378	135.0272	131.0458	138.0534	141.5510	161.5927	176.3899	200.3106	(62)
WWHRS	-54.4610	-48.1658	-50.4364	-41.7633	-38.9219	-33.3058	-31.2189	-33.1981	-34.4594	-40.6239	-46.0219	-53.4525	(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													
	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
										Total per year (kWh/year) = Sum(64)m =		1462.4467	(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													
	67.0703	59.0462	62.1020	53.1617	50.5430	44.4712	43.1346	45.4634	46.6393	53.2864	58.2175	66.1537	(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	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.0493	19.5840	15.9268	12.0576	9.0132	7.6093	8.2221	10.6874	14.3447	18.2139	21.2583	22.6621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	288.3618	291.3541	283.8136	267.7608	247.4971	228.4520	215.7287	212.7364	220.2769	236.3297	256.5934	275.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)													
	90.1482	87.8663	83.4705	73.8356	67.9341	61.7655	57.9766	61.1068	64.7768	71.6215	80.8576	88.9163	(72)
Total internal gains													
	498.0444	496.2895	480.6960	451.1391	421.9294	392.3119	376.4125	379.0157	393.8834	423.6501	456.1944	484.7020	(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	
South	5.1200	46.7521	0.7300	0.7000	0.7700	84.7666	(78)
North	4.1400	10.6334	0.7300	0.7000	0.7700	15.5893	(74)
South	1.8500	46.7521	0.7300	0.7000	0.7700	30.6286	(78)
West	0.7000	19.6403	0.7300	0.7000	0.7700	4.8685	(80)

Solar gains	135.8530	228.3034	307.0450	376.2744	421.1016	418.8202	403.4016	369.2327	330.5858	250.6052	162.0846	116.7117	(83)
Total gains	633.8974	724.5930	787.7409	827.4135	843.0311	811.1320	779.8141	748.2484	724.4692	674.2552	618.2789	601.4137	(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	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	
alpha	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	
util living area													
	0.9788	0.9599	0.9240	0.8522	0.7254	0.5550	0.4059	0.4407	0.6504	0.8717	0.9615	0.9831	(86)
MIT	19.9590	20.1681	20.4297	20.6964	20.8893	20.9757	20.9956	20.9934	20.9487	20.7068	20.2712	19.8948	(87)
Th 2	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	(88)
util rest of house													
	0.9733	0.9500	0.9058	0.8184	0.6694	0.4779	0.3182	0.3505	0.5734	0.8347	0.9503	0.9787	(89)
MIT 2	18.8471	19.1071	19.4265	19.7379	19.9419	20.0178	20.0304	20.0294	19.9987	19.7580	19.2399	18.7665	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	19.1667	19.4121	19.7148	20.0134	20.2143	20.2931	20.3078	20.3065	20.2717	20.0307	19.5363	19.0908	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0167	19.2621	19.5648	19.8634	20.0643	20.1431	20.1578	20.1565	20.1217	19.8807	19.3863	18.9408	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9658	0.9403	0.8955	0.8118	0.6714	0.4870	0.3297	0.3622	0.5809	0.8280	0.9408	0.9720	(94)
Useful gains	612.2034	681.3385	705.4020	671.7131	566.0127	395.0149	257.1315	271.0523	420.8436	558.2936	581.6873	584.5927	(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													
	1066.9810	1041.2704	947.2206	794.8621	606.4205	401.8852	257.9454	272.3520	436.5844	672.8633	890.7746	1068.7285	(97)
Space heating kWh													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98a)
Space heating requirement - total per year (kWh/year)												1546.8522	
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													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1546.8522	
Space heating per m2											(98c) / (4) =	22.6612	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	338.3545	241.8742	179.9131	88.6673	30.0634	0.0000	0.0000	0.0000	0.0000	85.2398	222.5429	360.1970	(98)
Space heating efficiency (main heating system 1)													
	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)													
	380.1736	271.7688	202.1495	99.6261	33.7791	0.0000	0.0000	0.0000	0.0000	95.7751	250.0482	404.7158	(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													
	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4742	88.3963	88.2550	88.0164	87.6484	87.3000	87.3000	87.3000	87.3000	87.9948	88.3644	88.5009	(217)
Fuel for water heating, kWh/month													
	167.9670	147.7854	156.0056	135.6720	130.5396	116.5194	114.3494	120.1091	122.6708	137.4727	147.5346	165.9398	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.5311	8.6087	9.5311	9.2236	9.5311	9.2236	9.5311	9.5311	9.2236	9.5311	9.2236	9.5311	(231)
Lighting	19.2996	15.4829	13.9406	10.2135	7.8892	6.4455	7.1968	9.3547	12.1508	15.9425	18.0070	19.8360	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-16.6969	-24.3299	-35.9017	-41.7594	-46.5817	-44.0826	-43.6637	-40.5567	-35.4268	-28.5857	-18.7083	-14.3823	(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	-5.6885	-11.7532	-22.5350	-32.7705	-42.6407	-42.5752	-42.2897	-36.3608	-27.4742	-16.6867	-7.5846	-4.5303	(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	1738.0362	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1662.5653	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.4420, total flow = 42.0000, SFP = 0.1296)		
mechanical ventilation fans (SFP = 0.1296)	26.2205	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.2205	(231)
Electricity for lighting (calculated in Appendix L)	155.7591	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-683.5651	(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	2985.0160	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1738.0362	3.6400	63.2645	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.5653	3.6400	60.5174	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	112.2205	16.4900	18.5052	(249)
Energy for lighting	155.7591	16.4900	25.6847	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	16.4900	-64.4224	

PV Unit electricity exported	-292.8894	5.5900	-16.3725	
Total			-80.7949	(252)
Total energy cost			179.1768	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.3600	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.5695	(257)
SAP value			90.7681	
SAP rating (Section 12)			91	(258)
SAP band			B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1738.0362	0.2100	364.9876	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1662.5653	0.2100	349.1387	(264)
Space and water heating			714.1263	(265)
Pumps, fans and electric keep-hot	112.2205	0.1387	15.5664	(267)
Energy for lighting	155.7591	0.1443	22.4809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-390.6757	0.1338	-52.2856	
PV Unit electricity exported	-292.8894	0.1266	-37.0906	
Total			-89.3762	(269)
Total CO2, kg/year			662.7973	(272)
CO2 emissions per m2			9.7100	(273)
EI value			92.1583	
EI rating			92	(274)
EI band			A	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	34.1300	(1b) x	2.3100	(2b) =	78.8403	(1b) - (3b)
First floor	34.1300	(1c) x	2.5500	(2c) =	87.0315	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.2600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		165.8718	(5)

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2. Ventilation rate

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.1998	0.1955	0.1913	0.1742	0.1700	0.1488	0.1445	0.1445	0.1573	0.1700	0.1700	0.1827	(22b)

Mechanical extract ventilation - decentralised

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

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

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3. Heat losses and heat loss parameter

Element	Gross	Openings	NetArea	U-value	A x U	K-value	A x K

	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
DWH Front door			2.4900	1.2000	2.9880			(26)
French doors - Eurcell Lo (Uw = 1.30)			5.1200	1.2357	6.3270			(27)
Window - Eurcell Logik (Uw = 1.30)			6.6900	1.2357	8.2671			(27)
B&B 225mm TE Platinum GF			34.1300	0.1000	3.4130	135.0000	4607.5500	(28a)
Full Fill Bead	80.7900	14.3000	66.4900	0.2300	15.2927	60.0000	3989.4001	(29a)
500mm Mineral Wool @ 0.044	34.1300		34.1300	0.0900	3.0717	10.0000	341.3000	(30)
Total net area of external elements Aum(A, m2)			149.0500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.3595			(33)
E-WM-22			35.9300	0.0000	0.0000	110.0000	3952.3000	(32)
63mm Timber			137.3300			9.0000	1235.9700	(32c)
1st floor			34.1300			18.0000	614.3400	(32d)
Ground ceiling			34.1300			9.0000	307.1700	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15048.0301 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 220.4517 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	9.3400	0.0260	0.2428
E3 Sill	5.8300	0.0310	0.1807
E4 Jamb	24.7500	0.0360	0.8910
E5 Ground floor (normal)	16.6300	0.0590	0.9812
E6 Intermediate floor within a dwelling	16.6300	0.0060	0.0998
E12 Gable (insulation at ceiling level)	9.2300	0.0560	0.5169
E10 Eaves (insulation at ceiling level)	7.3900	0.0780	0.5764
E16 Corner (normal)	9.7200	0.0520	0.5054
E18 Party wall between dwellings	9.7200	0.0530	0.5152
P1 Party wall - Ground floor	7.3900	0.0860	0.6355
P2 Party wall - Intermediate floor within a dwelling	7.3900	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	7.3900	0.0850	0.6281

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 5.7731 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 45.1326 (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	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	27.3688	(38)
Heat transfer coeff	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	72.5015	(39)
Average = Sum(39)m / 12 =												72.5015	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	1.0621	(40)
HLP (average)												1.0621	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.2032 (42)
Hot water usage for mixer showers

61.1592	60.2401	58.9008	56.3383	54.4472	52.3383	51.1395	52.4687	53.9258	56.1901	58.8077	60.9249	(42a)

Hot water usage for baths

26.4237	26.0313	25.4786	24.4597	23.6967	22.8507	22.3938	22.9425	23.5400	24.4453	25.4852	26.3344	(42b)

Hot water usage for other uses

37.1925	35.8400	34.4876	33.1351	31.7827	30.4302	30.4302	31.7827	33.1351	34.4876	35.8400	37.1925	(42c)

Average daily hot water use (litres/day) 114.6970 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	124.7754	122.1114	118.8670	113.9331	109.9266	105.6192	103.9635	107.1939	110.6009	115.1229	120.1329	124.4517	(44)
Energy conte	197.6137	173.8850	182.6942	155.9687	147.9823	129.8711	125.7349	132.7284	136.3819	156.2207	171.1513	194.8614	(45)
Energy content (annual)										Total = Sum(45)m =		1905.0938	
Distribution loss (46)m = 0.15 x (45)m	29.6421	26.0828	27.4041	23.3953	22.1973	19.4807	18.8602	19.9093	20.4573	23.4331	25.6727	29.2292	(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	5.4547	4.9177	5.4249	5.2082	5.3555	5.1560	5.3110	5.3250	5.1691	5.3720	5.2386	5.4492	(61)
Total heat required for water heating calculated for each month	203.0685	178.8027	188.1191	161.1770	153.3378	135.0272	131.0458	138.0534	141.5510	161.5927	176.3899	200.3106	(62)
WWHRS	-54.4610	-48.1658	-50.4364	-41.7633	-38.9219	-33.3058	-31.2189	-33.1981	-34.4594	-40.6239	-46.0219	-53.4525	(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	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
									Total per year (kWh/year) = Sum(64)m =			1462.4467	(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	67.0703	59.0462	62.1020	53.1617	50.5430	44.4712	43.1346	45.4634	46.6393	53.2864	58.2175	66.1537	(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	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	132.1891	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0493	19.5840	15.9268	12.0576	9.0132	7.6093	8.2221	10.6874	14.3447	18.2139	21.2583	22.6621	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3618	291.3541	283.8136	267.7608	247.4971	228.4520	215.7287	212.7364	220.2769	236.3297	256.5934	275.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	50.4221	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	-88.1260	(71)
Water heating gains (Table 5)	90.1482	87.8663	83.4705	73.8356	67.9341	61.7655	57.9766	61.1068	64.7768	71.6215	80.8576	88.9163	(72)
Total internal gains	498.0444	496.2895	480.6960	451.1391	421.9294	392.3119	376.4125	379.0157	393.8834	423.6501	456.1944	484.7020	(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	
South	5.1200	53.3164	0.7300	0.7000	0.7700	96.6685	(78)
North	4.1400	12.4405	0.7300	0.7000	0.7700	18.2387	(74)
South	1.8500	53.3164	0.7300	0.7000	0.7700	34.9290	(78)
West	0.7000	23.1469	0.7300	0.7000	0.7700	5.7378	(80)

Solar gains	155.5740	231.6199	308.8029	386.1959	422.4552	448.2949	420.4300	388.7090	348.0684	263.0687	179.2650	128.1271	(83)
Total gains	653.6184	727.9094	789.4988	837.3350	844.3846	840.6068	796.8425	767.7247	741.9517	686.7188	635.4594	612.8291	(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	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	57.6541	
alpha	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	4.8436	
util living area	0.9767	0.9610	0.9251	0.8476	0.7191	0.5224	0.3887	0.4121	0.6381	0.8652	0.9586	0.9827	(86)
MIT	19.9778	20.1496	20.4213	20.7045	20.8946	20.9817	20.9964	20.9953	20.9527	20.7181	20.2843	19.8885	(87)
Th 2	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	20.0319	(88)
util rest of house	0.9708	0.9515	0.9073	0.8133	0.6624	0.4459	0.3025	0.3232	0.5615	0.8271	0.9468	0.9782	(89)
MIT 2	18.8703	19.0838	19.4163	19.7465	19.9470	20.0218	20.0307	20.0302	20.0015	19.7698	19.2554	18.7582	(90)
Living area fraction									fLA = Living area / (4) =			0.2874	(91)
MIT	19.1887	19.3902	19.7052	20.0219	20.2193	20.2977	20.3083	20.3076	20.2749	20.0423	19.5511	19.0831	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0387	19.2402	19.5552	19.8719	20.0693	20.1477	20.1583	20.1576	20.1249	19.8923	19.4011	18.9331	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9629	0.9418	0.8969	0.8069	0.6647	0.4553	0.3139	0.3348	0.5692	0.8209	0.9371	0.9714	(94)
Useful gains	629.3441	685.5757	708.0942	675.6844	561.2656	382.7418	250.0945	257.0627	422.3545	563.6931	595.5069	595.3080	(95)
Ext temp.	4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W	1075.8240	1054.1823	953.7687	795.4786	599.5381	387.7172	250.7303	257.9337	436.8123	673.7088	899.0990	1082.6713	(97)
Space heating kWh	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98a)
Space heating requirement - total per year (kWh/year)												1540.4294	
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	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1540.4294	
Space heating per m2											(98c) / (4) =	22.5671	(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 %)	89.0000	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.1810	247.7037	182.7818	86.2518	28.4748	0.0000	0.0000	0.0000	0.0000	81.8516	218.5863	362.5983	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	373.2371	278.3187	205.3728	96.9122	31.9941	0.0000	0.0000	0.0000	0.0000	91.9681	245.6026	407.4139	(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	148.6075	130.6369	137.6827	119.4136	114.4159	101.7214	99.8270	104.8553	107.0916	120.9688	130.3680	146.8581	(64)
Efficiency of water heater												87.3000	(216)
(217)m	88.4675	88.4056	88.2616	88.0050	87.6336	87.3000	87.3000	87.3000	87.3000	87.9782	88.3572	88.5032	(217)
Fuel for water heating, kWh/month	167.9797	147.7700	155.9939	135.6896	130.5617	116.5194	114.3494	120.1091	122.6708	137.4986	147.5466	165.9354	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	9.5311	8.6087	9.5311	9.2236	9.5311	9.2236	9.5311	9.5311	9.2236	9.5311	9.2236	9.5311	(231)
Lighting	19.2996	15.4829	13.9406	10.2135	7.8892	6.4455	7.1968	9.3547	12.1508	15.9425	18.0070	19.8360	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.8984	-24.8413	-36.3473	-42.7457	-46.7963	-46.1336	-44.9344	-42.1342	-36.9803	-29.9248	-20.5120	-15.7241	(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	-7.0234	-12.1957	-23.0584	-34.3062	-43.0428	-46.8208	-44.8974	-39.3042	-29.8861	-18.1532	-8.9001	-5.2648	(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	1730.8196	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	87.3000	
Water heating fuel used	1662.6241	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 5.4420, total flow = 42.0000, SFP = 0.1296)		
mechanical ventilation fans (SFP = 0.1296)	26.2205	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	112.2205	(231)
Electricity for lighting (calculated in Appendix L)	155.7591	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-718.8257	(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	2942.5975	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1730.8196	6.1900	107.1377	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.6241	6.1900	102.9164	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	112.2205	25.1600	28.2347	(249)
Energy for lighting	155.7591	25.1600	39.1890	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-405.9725	25.1600	-102.1427	
PV Unit electricity exported	-312.8532	5.8100	-18.1768	
Total			-120.3195	(252)
Total energy cost			259.1584	(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	1730.8196	0.2100	363.4721	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1662.6241	0.2100	349.1511	(264)
Space and water heating			712.6232	(265)
Pumps, fans and electric keep-hot	112.2205	0.1387	15.5664	(267)
Energy for lighting	155.7591	0.1443	22.4809	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-405.9725	0.1340	-54.3904	
PV Unit electricity exported	-312.8532	0.1266	-39.6131	
Total			-94.0036	(269)
Total CO2, kg/year			656.6668	(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	1730.8196	1.1300	1955.8261	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1662.6241	1.1300	1878.7652	(278)
Space and water heating			3834.5913	(279)
Pumps, fans and electric keep-hot	112.2205	1.5128	169.7672	(281)
Energy for lighting	155.7591	1.5338	238.9085	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-405.9725	1.4951	-606.9693	
PV Unit electricity exported	-312.8532	0.4647	-145.3979	
Total			-752.3672	(283)
Total Primary energy kWh/year			3490.8998	(286)

Full SAP Calculation Printout

Property Reference	Plot 142 H469 09RE Det	**Issued on Date**	18/03/2024
Assessment Reference	1	**Prop Type Ref**	1
Property	Plot 142, The Pavilions, Bodicote, OX15		

SAP Rating	93 A	**DER**	8.95	**TER**	9.38
Environmental	91 B	**% DER < TER**			4.58
CO_2 Emissions (t/year)	1.2	**DFEE**	39.41	**TFEE**	40.10
Compliance Check	See BREL	**% DFEE < TFEE**			1.71
% DPER < TPER	7.71	**DPER**	45.29	**TPER**	49.07

Assessor Details	Ms. Alina Spataru	**Assessor ID**	BD89-0001
Client	BDW Mercia, BDW Mercia		

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(5)

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2. Ventilation rate

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				m3 per hour	
Number of open chimneys			0 * 80 =	0.0000	(6a)
Number of open flues			0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire			0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler			0 * 20 =	0.0000	(6d)
Number of flues attached to other heater			0 * 35 =	0.0000	(6e)
Number of blocked chimneys			0 * 20 =	0.0000	(6f)
Number of intermittent extract fans			1 * 10 =	10.0000	(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) =			10.0000 / (5) =	0.0288	(8)
Pressure test				Yes	
Pressure Test Method				Blower Door	
Measured/design AP50				4.0000	(17)
Infiltration rate				0.2288	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1945	(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	0.2480	0.2431	0.2383	0.2140	0.2091	0.1848	0.1848	0.1799	0.1945	0.2091	0.2188	0.2285	(22b)

Mechanical extract ventilation - decentralised

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28209.3538 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.2820 (35)
List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3	Sill	16.5600	0.0310	0.5134
E4	Jamb	49.9500	0.0360	1.7982
E5	Ground floor (normal)	36.8100	0.0590	2.1718
E6	Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4	Jamb	4.6500	0.0470	0.2186
E4	Jamb	4.2000	0.0670	0.2814
E4	Jamb	3.0000	0.0830	0.2490
E12	Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10	Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12	Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16	Corner (normal)	24.3500	0.0520	1.2662
E17	Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1321 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 94.4259 (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	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	(38)
Heat transfer coeff	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	(39)

Average = Sum(39)m / 12 = 151.6572

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	(40)
HLP (average)												1.0606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9226 (42)
Hot water usage for mixer showers

73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)

Hot water usage for baths

31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)

Hot water usage for other uses

44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)

Average daily hot water use (litres/day) 137.3255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3400	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7236	(55)
Total storage loss	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(56)
If cylinder contains dedicated solar storage	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	282.2957	249.4625	264.4309	230.9590	222.8706	199.7122	196.2346	204.6085	207.5093	232.7362	249.1384	279.0004	(62)
WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975	(63a)
PV diverter	-10.8369	-26.4166	-62.8934	-110.1936	-159.2803	-165.4385	-161.3220	-127.9697	-82.6671	-40.6971	-15.1628	-8.2122	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	238.8576	194.2131	171.3455	95.7652	40.2911	14.3364	16.2245	56.7658	104.2142	167.7210	206.4261	238.7908	(64)
										Total per year (kWh/year) = Sum(64)m =		1544.9512	(64)
12Total per year (kWh/year)												1545	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month	115.2253	102.2410	109.2852	97.4667	95.4664	87.0772	86.6099	89.3943	89.6697	98.7467	103.5114	114.1296	(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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.6934	179.0177	161.6934	167.0832	161.6934	167.0832	161.6934	161.6934	167.0832	161.6934	167.0832	161.6934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	(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)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)
Water heating gains (Table 5)	154.8727	152.1443	146.8887	135.3704	128.3151	120.9405	116.4112	120.1536	124.5412	132.7241	143.7658	153.4000	(72)
Total internal gains	699.1913	717.0330	686.2740	662.7330	628.3077	602.6646	578.9446	579.4412	597.3978	620.6034	659.0150	683.9177	(73)

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6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains

	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W	
North	1.9600	10.6334	0.7300	0.7000	0.7700	7.3804	(74)
South	1.9600	46.7521	0.7300	0.7000	0.7700	32.4497	(78)
West	7.0700	19.6403	0.7300	0.7000	0.7700	49.1723	(80)
North	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705	(74)
East	6.7300	19.6403	0.7300	0.7000	0.7700	46.8076	(76)
South	0.6600	46.7521	0.7300	0.7000	0.7700	10.9269	(78)
West	5.5000	19.6403	0.7300	0.7000	0.7700	38.2529	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	189.9604	357.2310	563.0447	797.3941	966.3022	986.7135	940.2470	813.2065	645.7035	416.3024	234.0252	158.1643	(83)
Total gains	889.1518	1074.2640	1249.3187	1460.1270	1594.6099	1589.3781	1519.1916	1392.6476	1243.1013	1036.9058	893.0402	842.0820	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	
alpha	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	
util living area	0.9938	0.9853	0.9633	0.8961	0.7630	0.5822	0.4328	0.4891	0.7400	0.9409	0.9872	0.9951	(86)
MIT	19.4869	19.7308	20.0865	20.5167	20.8223	20.9584	20.9910	20.9849	20.8839	20.4479	19.8747	19.4310	(87)
Th 2	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	(88)
util rest of house	0.9922	0.9815	0.9538	0.8703	0.7111	0.5046	0.3408	0.3917	0.6664	0.9204	0.9833	0.9938	(89)
MIT 2	18.2624	18.5723	19.0196	19.5413	19.8802	20.0072	20.0297	20.0267	19.9491	19.4724	18.7576	18.1912	(90)
Living area fraction									fLA = Living area / (4) =			0.1478	(91)
MIT	18.4435	18.7436	19.1774	19.6855	20.0194	20.1478	20.1718	20.1684	20.0873	19.6166	18.9228	18.3745	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2935	18.5936	19.0274	19.5355	19.8694	19.9978	20.0218	20.0184	19.9373	19.4666	18.7728	18.2245	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9877	0.9735	0.9408	0.8545	0.7014	0.5016	0.3397	0.3902	0.6583	0.9048	0.9757	0.9901	(94)
Useful gains	878.2429	1045.7785	1175.3848	1247.6909	1118.4401	797.2421	516.0459	543.4210	818.3706	938.1662	871.3751	833.7496	(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	2122.2085	2076.7300	1899.8645	1612.9570	1238.9555	818.6204	518.9398	548.7529	885.2681	1344.6824	1770.2578	2126.9203	(97)
Space heating kWh	925.5104	692.7994	539.0129	262.9916	89.6635	0.0000	0.0000	0.0000	0.0000	302.4481	647.1956	962.1190	(98a)
Space heating requirement - total per year (kWh/year)												4421.7405	
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	925.5104	692.7994	539.0129	262.9916	89.6635	0.0000	0.0000	0.0000	0.0000	302.4481	647.1956	962.1190	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4421.7405	
Space heating per m2											(98c) / (4) =	30.9234	(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 %)	88.9000	(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	925.5104	692.7994	539.0129	262.9916	89.6635	0.0000	0.0000	0.0000	0.0000	302.4481	647.1956	962.1190	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	1041.0690	779.3019	606.3137	295.8286	100.8588	0.0000	0.0000	0.0000	0.0000	340.2115	728.0040	1082.2486	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.8576	194.2131	171.3455	95.7652	40.2911	14.3364	16.2245	56.7658	104.2142	167.7210	206.4261	238.7908	(64)
Efficiency of water heater												79.9000	(216)
(217)m	86.8922	86.7602	86.5485	86.3050	85.9001	79.9000	79.9000	79.9000	79.9000	85.4658	86.5426	86.9525	(217)
Fuel for water heating, kWh/month	274.8896	223.8504	197.9763	110.9613	46.9046	17.9429	20.3060	71.0461	130.4308	196.2434	238.5253	274.6222	(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	12.8485	11.6051	12.8485	12.4340	12.8485	12.4340	12.8485	12.8485	12.4340	12.8485	12.4340	12.8485	(231)
Lighting	32.3266	25.9336	23.3503	17.1074	13.2143	10.7962	12.0545	15.6689	20.3524	26.7034	30.1614	33.2250	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6260	-55.8498	-89.6772	-109.5000	-122.9722	-116.2352	-114.2011	-104.9723	-88.5561	-67.2251	-40.6661	-29.8893	(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	-3.0102	-7.3380	-17.4704	-30.6093	-44.2445	-45.9551	-44.8117	-35.5471	-22.9631	-11.3048	-4.2119	-2.2812	(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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	4973.8363	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	1803.6988	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	65.2801	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	151.2801	(231)
Electricity for lighting (calculated in Appendix L)	260.8940	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1245.1177	(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	-311.7400	(236)
Energy used	77.0400	(237)
Total delivered energy for all uses	5709.8915	(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	4973.8363	0.2100	1044.5056	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1803.6988	0.2100	378.7768	(264)
Space and water heating			1423.2824	(265)
Pumps, fans and electric keep-hot	151.2801	0.1387	20.9844	(267)
Energy for lighting	260.8940	0.1443	37.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.3704	0.1330	-129.6949	
PV Unit electricity exported	-269.7473	0.1223	-32.9793	
Total			-162.6742	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1280.1297	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			8.9500	(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	4973.8363	1.1300	5620.4350	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1803.6988	1.1300	2038.1797	(278)
Space and water heating			7658.6147	(279)
Pumps, fans and electric keep-hot	151.2801	1.5128	228.8566	(281)
Energy for lighting	260.8940	1.5338	400.1679	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.3704	1.4914	-1454.6190	
PV Unit electricity exported	-269.7473	0.4486	-121.0092	
Total			-1575.6282	(283)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	1.1300	-352.2662	(284)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	1.5010	115.6370	(285)
Total Primary energy kWh/year			6475.3818	(286)
Dwelling Primary energy Rate (DPER)			45.2900	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)

Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1153	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3653	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3105	(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	0.3959	0.3882	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649	(22b)
Effective ac	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.3700	1.0000	2.3700			(26)
TER Semi-glazed door			2.0000	1.0000	2.0000			(26a)
TER Opening Type (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
225mm TE Platinum GF B&B			73.8400	0.1300	9.5992			(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.1800	25.5582			(29a)
500mm MW @ 0.044	69.1500		69.1500	0.1100	7.6065			(30)
Lightpod Roof	4.1500		4.1500	0.1100	0.4565			(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		76.4454			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.2820	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	18.5300	0.0500	0.9265
E3 Sill	16.5600	0.0500	0.8280
E4 Jamb	49.9500	0.0500	2.4975
E5 Ground floor (normal)	36.8100	0.1600	5.8896
E6 Intermediate floor within a dwelling	34.0100	0.0000	0.0000
E4 Jamb	4.6500	0.0500	0.2325
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	3.0000	0.0500	0.1500
E12 Gable (insulation at ceiling level)	17.5300	0.0600	1.0518
E10 Eaves (insulation at ceiling level)	18.7100	0.0600	1.1226
E12 Gable (insulation at ceiling level)	3.7800	0.0600	0.2268
E16 Corner (normal)	24.3500	0.0900	2.1915
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0900	-0.4383

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.8885	(36)
Point Thermal bridges	(36a) = 0.0000	
Total fabric heat loss	(33) + (36) + (36a) = 91.3339	(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	66.2023	65.8539	65.5125	63.9086	63.6086	62.2117	62.2117	61.9530	62.7497	63.6086	64.2156	64.8502	(38)
Heat transfer coeff	157.5361	157.1878	156.8463	155.2425	154.9424	153.5456	153.5456	153.2869	154.0836	154.9424	155.5495	156.1841	(39)
Average = Sum(39)m / 12 =												155.2411	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1017	1.0993	1.0969	1.0857	1.0836	1.0738	1.0738	1.0720	1.0776	1.0836	1.0878	1.0923	(40)
HLP (average)												1.0857	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9226	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)
Hot water usage for baths	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)
Average daily hot water use (litres/day)												137.3255	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)

Water storage loss:		
Store volume	180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.8381	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	285.8444	252.6678	267.9796	234.3932	226.4193	203.1464	199.7832	208.1571	210.9435	236.2849	252.5726	282.5491	(62)
WWHRS	-33.4739	-29.6046	-31.0003	-25.6694	-23.9230	-20.4711	-19.1884	-20.4049	-21.1802	-24.9691	-28.2869	-32.8540	(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													
	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951	(64)
									Total per year (kWh/year) = Sum(64)m =			2549.7153	(64)
12Total per year (kWh/year)												2550	(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													
	118.0642	104.8052	112.1242	100.2141	98.3054	89.8245	89.4489	92.2332	92.4170	101.5857	106.2587	116.9685	(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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	161.6934	179.0177	161.6934	167.0832	161.6934	167.0832	161.6934	161.6934	167.0832	161.6934	167.0832	161.6934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	(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)													
	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)
Water heating gains (Table 5)													
	158.6884	155.9601	150.7045	139.1862	132.1309	124.7563	120.2270	123.9694	128.3570	136.5399	147.5816	157.2158	(72)
Total internal gains													
	703.0071	720.8488	690.0898	666.5487	632.1235	606.4804	582.7603	583.2570	601.2136	624.4192	662.8308	687.7335	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2800	10.6334	0.6300	0.7000	0.7700	10.6590	(74)
East	6.7300	19.6403	0.6300	0.7000	0.7700	40.3956	(76)
South	2.6200	46.7521	0.6300	0.7000	0.7700	37.4347	(78)
West	12.5700	19.6403	0.6300	0.7000	0.7700	75.4492	(80)

Solar gains	163.9385	308.2952	485.9153	688.1620	833.9320	851.5473	811.4461	701.8083	557.2509	359.2747	201.9669	136.4980	(83)
Total gains	866.9456	1029.1440	1176.0051	1354.7107	1466.0555	1458.0277	1394.2064	1285.0653	1158.4645	983.6938	864.7977	824.2315	(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	49.7405	49.8508	49.9593	50.4754	50.5732	51.0333	51.0333	51.1194	50.8551	50.5732	50.3758	50.1711	
alpha	4.3160	4.3234	4.3306	4.3650	4.3715	4.4022	4.4022	4.4080	4.3903	4.3715	4.3584	4.3447	
util living area													
	0.9944	0.9878	0.9714	0.9190	0.8067	0.6301	0.4741	0.5304	0.7779	0.9515	0.9889	0.9955	(86)
MIT	19.3918	19.6225	19.9697	20.4220	20.7643	20.9414	20.9866	20.9785	20.8519	20.3834	19.8080	19.3569	(87)
Th 2	19.9994	20.0014	20.0034	20.0125	20.0143	20.0223	20.0223	20.0238	20.0192	20.0143	20.0108	20.0071	(88)
util rest of house													
	0.9929	0.9845	0.9636	0.8971	0.7578	0.5492	0.3737	0.4261	0.7064	0.9339	0.9854	0.9943	(89)
MIT 2	18.1182	18.4132	18.8532	19.4156	19.8065	19.9849	20.0170	20.0145	19.9093	19.3816	18.6577	18.0788	(90)
Living area fraction										fLA = Living area / (4) =		0.1478	(91)
MIT	18.3065	18.5920	19.0183	19.5644	19.9481	20.1263	20.1604	20.1570	20.0486	19.5297	18.8278	18.2678	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3065	18.5920	19.0183	19.5644	19.9481	20.1263	20.1604	20.1570	20.0486	19.5297	18.8278	18.2678	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9892	0.9781	0.9534	0.8851	0.7541	0.5583	0.3882	0.4409	0.7088	0.9225	0.9793	0.9911	(94)
Useful gains	857.5440	1006.5816	1121.2040	1199.0597	1105.5427	813.9518	541.2514	566.5369	821.1278	907.5034	846.8906	816.9185	(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													
	2206.5230	2152.2112	1963.4454	1655.5686	1277.9854	848.5383	546.6764	575.8983	916.5868	1383.5963	1824.2511	2197.1647	(97)
Space heating kWh													
	1003.6404	769.8631	626.6276	328.6864	128.2974	0.0000	0.0000	0.0000	0.0000	354.2131	703.6996	1026.9032	(98a)
Space heating requirement - total per year (kWh/year)												4941.9309	
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													
	1003.6404	769.8631	626.6276	328.6864	128.2974	0.0000	0.0000	0.0000	0.0000	354.2131	703.6996	1026.9032	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4941.9309	
Space heating per m2											(98c) / (4) =	34.5614	(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													
	1003.6404	769.8631	626.6276	328.6864	128.2974	0.0000	0.0000	0.0000	0.0000	354.2131	703.6996	1026.9032	(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)													
	1087.3677	834.0879	678.9032	356.1066	139.0004	0.0000	0.0000	0.0000	0.0000	383.7628	762.4048	1112.5712	(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													
	252.3704	223.0632	236.9793	208.7237	202.4963	182.6753	180.5949	187.7522	189.7633	211.3158	224.2856	249.6951	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.8323	86.6057	86.1343	85.0735	83.0652	79.8000	79.8000	79.8000	79.8000	85.2091	86.4437	86.8834	(217)
Fuel for water heating, kWh/month													
	290.6413	257.5618	275.1277	245.3451	243.7800	228.9165	226.3093	235.2785	237.7986	247.9968	259.4587	287.3910	(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	33.5967	26.9525	24.2678	17.7796	13.7335	11.2204	12.5281	16.2845	21.1520	27.7526	31.3465	34.5304	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-64.1608	-88.0453	-123.1872	-134.6355	-141.9042	-131.1736	-129.4068	-123.6546	-113.1793	-98.6775	-69.6149	-55.7452	(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	-43.9555	-91.4631	-180.0286	-267.9424	-352.0370	-353.0198	-348.9942	-296.6265	-218.8485	-130.1288	-58.4500	-34.8476	(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	5354.2046	(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	3035.6053	(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)	271.1446	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-3649.7268	(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	5097.2276	(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	5354.2046	0.2100	1124.3830	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3035.6053	0.2100	637.4771	(264)
Space and water heating			1761.8601	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	271.1446	0.1443	39.1345	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1273.3849	0.1352	-172.1580	
PV Unit electricity exported	-2376.3419	0.1262	-299.7942	
Total			-471.9521	(269)
Total CO2, kg/year			1340.9717	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			9.3800	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	5354.2046	1.1300	6050.2512	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3035.6053	1.1300	3430.2340	(278)
Space and water heating			9480.4852	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	271.1446	1.5338	415.8906	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1273.3849	1.4997	-1909.6950	
PV Unit electricity exported	-2376.3419	0.4631	-1100.4773	
Total			-3010.1723	(283)
Total Primary energy kWh/year			7016.3043	(286)
Target Primary Energy Rate (TPER)			49.0700	(287)

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

CALCULATION OF FABRIC ENERGY EFFICIENCY

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1153	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.3153	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2680	(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	0.3417	0.3350	0.3283	0.2948	0.2881	0.2546	0.2546	0.2479	0.2680	0.2881	0.3015	0.3149	(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	0.5584	0.5561	0.5539	0.5435	0.5415	0.5324	0.5324	0.5307	0.5359	0.5415	0.5455	0.5496	(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	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	28209.3538	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		197.2820	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3 Sill	16.5600	0.0310	0.5134
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E12 Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10 Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.1321	(36)
Point Thermal bridges	(36a) =	0.0000	
Total fabric heat loss	(33) + (36) + (36a) =	94.4259	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.9147	63.6551	63.4007	62.2059	61.9824	60.9417	60.9417	60.7490	61.3425	61.9824	62.4346	62.9074	(38)
Heat transfer coeff	158.3406	158.0811	157.8267	156.6318	156.4083	155.3676	155.3676	155.1749	155.7685	156.4083	156.8605	157.3333	(39)
Average = Sum(39)m / 12 =												156.6308	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1074	1.1055	1.1038	1.0954	1.0938	1.0866	1.0866	1.0852	1.0894	1.0938	1.0970	1.1003	(40)
HLP (average)												1.0954	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9226 (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

31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)

Hot water usage for other uses

44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)

Average daily hot water use (litres/day) 69.8175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.1710	74.0812	71.7997	68.9604	66.4273	63.7948	63.2481	65.5250	67.8602	70.5635	73.4279	76.0642	(44)
Energy conte	120.6363	105.4906	110.3535	94.4033	89.4239	78.4432	76.4932	81.1336	83.6784	95.7540	104.6115	119.0981	(45)

Energy content (annual) Total = Sum(45)m = 1159.5197

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

102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	(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

102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	(64)

Total per year (kWh/year) = Sum(64)m = 985.5917 (64)

12Total per year (kWh/year) 986 (64)

Electric shower(s)

58.6384	52.2473	57.0521	54.4441	55.4657	52.9089	54.6725	55.4657	54.4441	57.0521	55.9793	58.6384	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 667.0087 (64a)

Heat gains from water heating, kWh/month

40.2948	35.4786	37.7131	33.6717	32.8690	29.8964	29.9229	31.1073	31.3927	34.6107	36.2248	39.9680	(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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	(66)

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

161.6934	179.0177	161.6934	167.0832	161.6934	167.0832	161.6934	161.6934	167.0832	161.6934	167.0832	161.6934	(67)

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

312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857	(68)

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

37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	(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)

-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)

Water heating gains (Table 5)

54.1597	52.7955	50.6897	46.7663	44.1788	41.5228	40.2190	41.8109	43.6009	46.5198	50.3122	53.7204	(72)

Total internal gains

595.4784	614.6842	587.0750	571.1288	541.1714	523.2469	502.7524	501.0985	516.4575	531.3991	562.5614	581.2381	(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	1.9600	10.6334	0.7300	0.7000	0.7700	7.3804	(74)
South	1.9600	46.7521	0.7300	0.7000	0.7700	32.4497	(78)
West	7.0700	19.6403	0.7300	0.7000	0.7700	49.1723	(80)
North	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705	(74)
East	6.7300	19.6403	0.7300	0.7000	0.7700	46.8076	(76)
South	0.6600	46.7521	0.7300	0.7000	0.7700	10.9269	(78)
West	5.5000	19.6403	0.7300	0.7000	0.7700	38.2529	(80)

Solar gains	189.9604	357.2310	563.0447	797.3941	966.3022	986.7135	940.2470	813.2065	645.7035	416.3024	234.0252	158.1643	(83)
Total gains	785.4388	971.9152	1150.1197	1368.5229	1507.4735	1509.9604	1442.9994	1314.3050	1162.1610	947.7015	796.5866	739.4024	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.4878	49.5691	49.6490	50.0277	50.0992	50.4348	50.4348	50.4974	50.3050	50.0992	49.9548	49.8047	
alpha	4.2992	4.3046	4.3099	4.3352	4.3399	4.3623	4.3623	4.3665	4.3537	4.3399	4.3303	4.3203	
util living area	0.9962	0.9901	0.9737	0.9178	0.7979	0.6178	0.4640	0.5252	0.7801	0.9576	0.9919	0.9971	(86)
MIT	19.3092	19.5621	19.9379	20.4180	20.7707	20.9440	20.9872	20.9785	20.8467	20.3450	19.7346	19.2665	(87)
Th 2	19.9948	19.9963	19.9978	20.0046	20.0059	20.0118	20.0118	20.0129	20.0095	20.0059	20.0033	20.0006	(88)
util rest of house	0.9952	0.9875	0.9664	0.8955	0.7478	0.5368	0.3644	0.4206	0.7083	0.9417	0.9892	0.9963	(89)
MIT 2	18.4478	18.7002	19.0718	19.5368	19.8494	19.9842	20.0079	20.0057	19.9208	19.4787	18.8783	18.4095	(90)

Living area fraction fLA = Living area / (4) = 0.1478 (91)

MIT	18.5752	18.8276	19.1999	19.6671	19.9856	20.1261	20.1527	20.1496	20.0577	19.6068	19.0049	18.5362	(92)

Temperature adjustment 0.0000

adjusted MIT	18.5752	18.8276	19.1999	19.6671	19.9856	20.1261	20.1527	20.1496	20.0577	19.6068	19.0049	18.5362	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9930	0.9832	0.9590	0.8866	0.7467	0.5466	0.3789	0.4356	0.7122	0.9334	0.9855	0.9946	(94)
Useful gains	779.9723	955.6326	1102.9136	1213.2888	1125.6305	825.4132	546.7928	572.4802	827.7470	884.5855	785.0488	735.3764	(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	2260.3430	2201.6917	2004.3802	1686.4652	1295.9392	858.5743	551.9744	581.8369	928.0196	1408.7380	1867.4037	2255.5629	(97)
Space heating kWh	1101.3958	837.3517	670.6911	340.6870	126.7097	0.0000	0.0000	0.0000	0.0000	389.9695	779.2955	1131.0188	(98a)
Space heating requirement - total per year (kWh/year)												5377.1192	
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	1101.3958	837.3517	670.6911	340.6870	126.7097	0.0000	0.0000	0.0000	0.0000	389.9695	779.2955	1131.0188	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5377.1192	
Space heating per m2											(98c) / (4) =	37.6049	(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	1460.4556	1149.7203	1179.3292	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8682	0.9223	0.8911	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1267.9519	1060.4241	1050.9431	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1692.7355	1617.6612	1470.5033	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	305.8442	414.5844	312.1528	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	76.4611	103.6461	78.0382	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												258.1454	(107)
Energy for space heating												37.6049	(99)
Energy for space cooling												1.8053	(108)
Total												39.4102	(109)
Fabric Energy Efficiency (DFEE)												39.4	(109)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)		
Ground floor	73.8400	(1b)	x 2.3000	(2b)	= 169.8320	(1b) - (3b)	
First floor	69.1500	(1c)	x 2.5600	(2c)	= 177.0240	(1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)	
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		346.8560	(5)	

2. Ventilation rate

			m3 per hour	
Number of open chimneys		0 * 80 =	0.0000	(6a)
Number of open flues		0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire		0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler		0 * 20 =	0.0000	(6d)
Number of flues attached to other heater		0 * 35 =	0.0000	(6e)
Number of blocked chimneys		0 * 20 =	0.0000	(6f)
Number of intermittent extract fans		4 * 10 =	40.0000	(7a)
Number of passive vents		0 * 10 =	0.0000	(7b)
Number of flueless gas fires		0 * 40 =	0.0000	(7c)
			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =		40.0000 / (5) =	0.1153	(8)
Pressure test			Yes	
Pressure Test Method			Blower Door	
Measured/design AP50			5.0000	(17)
Infiltration rate			0.3653	(18)
Number of sides sheltered			2	(19)
Shelter factor		(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor		(21) = (18) x (20) =	0.3105	(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	0.3959	0.3882	0.3804	0.3416	0.3338	0.2950	0.2950	0.2872	0.3105	0.3338	0.3493	0.3649	(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	0.5784	0.5753	0.5723	0.5583	0.5557	0.5435	0.5435	0.5413	0.5482	0.5557	0.5610	0.5666	(25)

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.3700	1.0000	2.3700			(26)
TER Semi-glazed door			2.0000	1.0000	2.0000			(26a)
TER Opening Type (Uw = 1.20)			25.2000	1.1450	28.8550			(27)
225mm TE Platinum GF B&B			73.8400	0.1300	9.5992			(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.1800	25.5582			(29a)
500mm MW @ 0.044	69.1500		69.1500	0.1100	7.6065			(30)
Lightpod Roof	4.1500		4.1500	0.1100	0.4565			(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.4454			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.2820 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	18.5300	0.0500	0.9265
E3	Sill	16.5600	0.0500	0.8280
E4	Jamb	49.9500	0.0500	2.4975
E5	Ground floor (normal)	36.8100	0.1600	5.8896
E6	Intermediate floor within a dwelling	34.0100	0.0000	0.0000
E4	Jamb	4.6500	0.0500	0.2325
E4	Jamb	4.2000	0.0500	0.2100
E4	Jamb	3.0000	0.0500	0.1500
E12	Gable (insulation at ceiling level)	17.5300	0.0600	1.0518
E10	Eaves (insulation at ceiling level)	18.7100	0.0600	1.1226
E12	Gable (insulation at ceiling level)	3.7800	0.0600	0.2268
E16	Corner (normal)	24.3500	0.0900	2.1915
E17	Corner (inverted - internal area greater than external area)	4.8700	-0.0900	-0.4383

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.8885 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 91.3339 (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	66.2023	65.8539	65.5125	63.9086	63.6086	62.2117	62.2117	61.9530	62.7497	63.6086	64.2156	64.8502	(38)
Heat transfer coeff	157.5361	157.1878	156.8463	155.2425	154.9424	153.5456	153.5456	153.2869	154.0836	154.9424	155.5495	156.1841	(39)

Average = Sum(39)m / 12 = 155.2411

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1017	1.0993	1.0969	1.0857	1.0836	1.0738	1.0738	1.0720	1.0776	1.0836	1.0878	1.0923	(40)
HLP (average)												1.0857	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9226 (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

31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)

Hot water usage for other uses

44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)

Average daily hot water use (litres/day) 69.8175 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	76.1710	74.0812	71.7997	68.9604	66.4273	63.7948	63.2481	65.5250	67.8602	70.5635	73.4279	76.0642	(44)
Energy conte	120.6363	105.4906	110.3535	94.4033	89.4239	78.4432	76.4932	81.1336	83.6784	95.7540	104.6115	119.0981	(45)

Energy content (annual) Total = Sum(45)m = 1159.5197

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

102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	(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

102.5409	89.6670	93.8005	80.2428	76.0103	66.6767	65.0192	68.9636	71.1266	81.3909	88.9198	101.2334	(64)

Total per year (kWh/year) = Sum(64)m = 985.5917 (64)

12Total per year (kWh/year) 986 (64)

Electric shower(s)

58.6384	52.2473	57.0521	54.4441	55.4657	52.9089	54.6725	55.4657	54.4441	57.0521	55.9793	58.6384	(64a)

Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m = 667.0087 (64a)

Heat gains from water heating, kWh/month

40.2948	35.4786	37.7131	33.6717	32.8690	29.8964	29.9229	31.1073	31.3927	34.6107	36.2248	39.9680	(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	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	146.1286	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	161.6934	179.0177	161.6934	167.0832	161.6934	167.0832	161.6934	161.6934	167.0832	161.6934	167.0832	161.6934	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	312.7867	316.0325	307.8533	290.4408	268.4606	247.8024	234.0014	230.7556	238.9348	256.3473	278.3275	298.9857	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	37.6129	(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)	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)

Water heating gains (Table 5)

	54.1597	52.7955	50.6897	46.7663	44.1788	41.5228	40.2190	41.8109	43.6009	46.5198	50.3122	53.7204 (72)
Total internal gains												
	595.4784	614.6842	587.0750	571.1288	541.1714	523.2469	502.7524	501.0985	516.4575	531.3991	562.5614	581.2381 (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	3.2800	10.6334	0.6300	0.7000	0.7700	10.6590	(74)
East	6.7300	19.6403	0.6300	0.7000	0.7700	40.3956	(76)
South	2.6200	46.7521	0.6300	0.7000	0.7700	37.4347	(78)
West	12.5700	19.6403	0.6300	0.7000	0.7700	75.4492	(80)

Solar gains	163.9385	308.2952	485.9153	688.1620	833.9320	851.5473	811.4461	701.8083	557.2509	359.2747	201.9669	136.4980	(83)
Total gains	759.4168	922.9795	1072.9902	1259.2908	1375.1034	1374.7942	1314.1984	1202.9068	1073.7084	890.6738	764.5284	717.7361	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.7405	49.8508	49.9593	50.4754	50.5732	51.0333	51.0333	51.1194	50.8551	50.5732	50.3758	50.1711	
alpha	4.3160	4.3234	4.3306	4.3650	4.3715	4.4022	4.4022	4.4080	4.3903	4.3715	4.3584	4.3447	
util living area	0.9967	0.9919	0.9792	0.9348	0.8324	0.6592	0.5004	0.5618	0.8104	0.9651	0.9930	0.9974	(86)
MIT	19.2961	19.5305	19.8863	20.3602	20.7294	20.9301	20.9835	20.9731	20.8236	20.3136	19.7204	19.2615	(87)
Th 2	19.9994	20.0014	20.0034	20.0125	20.0143	20.0223	20.0223	20.0238	20.0192	20.0143	20.0108	20.0071	(88)
util rest of house	0.9958	0.9896	0.9733	0.9162	0.7863	0.5775	0.3956	0.4534	0.7427	0.9515	0.9907	0.9967	(89)
MIT 2	18.4382	18.6729	19.0262	19.4911	19.8254	19.9869	20.0171	20.0145	19.9144	19.4563	18.8700	18.4095	(90)
Living area fraction									fLA = Living area / (4) =			0.1478	(91)
MIT	18.5650	18.7997	19.1533	19.6196	19.9590	20.1263	20.1600	20.1563	20.0488	19.5831	18.9957	18.5354	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5650	18.7997	19.1533	19.6196	19.9590	20.1263	20.1600	20.1563	20.0488	19.5831	18.9957	18.5354	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9939	0.9859	0.9667	0.9071	0.7834	0.5867	0.4108	0.4688	0.7450	0.9437	0.9874	0.9951	(94)
Useful gains	754.7487	909.9992	1037.2803	1142.3431	1077.3148	806.6300	539.8488	563.8972	799.8945	840.5580	754.9190	714.2491	(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	2247.2586	2184.8593	1984.6278	1664.1382	1279.6723	848.5451	546.6226	575.7854	916.6110	1391.8559	1850.3715	2238.9669	(97)
Space heating kWh	1110.4274	856.7060	704.8266	375.6924	150.5540	0.0000	0.0000	0.0000	0.0000	410.1656	788.7258	1134.3900	(98a)
Space heating requirement - total per year (kWh/year)												5531.4879	
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	1110.4274	856.7060	704.8266	375.6924	150.5540	0.0000	0.0000	0.0000	0.0000	410.1656	788.7258	1134.3900	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5531.4879	
Space heating per m2											(98c) / (4) =	38.6844	(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	1443.3282	1136.2371	1164.9802	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8390	0.9022	0.8673	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1210.9676	1025.1144	1010.4174	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1534.7490	1467.1146	1340.2977	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	233.1227	328.8482	245.4310	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	58.2807	82.2121	61.3577	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												201.8505	(107)
Energy for space heating												38.6844	(99)
Energy for space cooling												1.4116	(108)
Total												40.0961	(109)
Fabric Energy Efficiency (TFEE)												40.1	(109)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 142.9900						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(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	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0288	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2288	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1945	(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	0.2480	0.2431	0.2383	0.2140	0.2091	0.1848	0.1848	0.1799	0.1945	0.2091	0.2188	0.2285	(22b)

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	28209.3538 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		197.2820 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3 Sill	16.5600	0.0310	0.5134
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E12 Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10 Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K)		10.1321 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	94.4259 (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	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	(38)
Heat transfer coeff	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	(39)
Average = Sum(39)m / 12 =												151.6572	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	(40)
HLP (average)												1.0606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9226	(42)
Hot water usage for mixer showers													
	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)
Hot water usage for baths													
	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)
Hot water usage for other uses													
	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)
Average daily hot water use (litres/day)												137.3255	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m													
	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3400	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7236	(55)
Total storage loss													
	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(56)
If cylinder contains dedicated solar storage													
	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	282.2957	249.4625	264.4309	230.9590	222.8706	199.7122	196.2346	204.6085	207.5093	232.7362	249.1384	279.0004	(62)
WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975	(63a)
PV diverter	-10.8369	-26.4166	-62.8934	-110.1936	-159.2803	-165.4385	-161.3220	-127.9697	-82.6671	-40.6971	-15.1628	-8.2122	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	238.8576	194.2131	171.3455	95.7652	40.2911	14.3364	16.2245	56.7658	104.2142	167.7210	206.4261	238.7908	(64)
										Total per year (kWh/year) = Sum(64)m =		1544.9512	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
										Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =		0.0000	(64a)
Heat gains from water heating, kWh/month													
	115.2253	102.2410	109.2852	97.4667	95.4664	87.0772	86.6099	89.3943	89.6697	98.7467	103.5114	114.1296	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.9322	32.8029	26.6771	20.1963	15.0970	12.7455	13.7719	17.9013	24.0271	30.5079	35.6072	37.9587	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	466.8458	471.6902	459.4825	433.4937	400.6875	369.8543	349.2558	344.4114	356.6191	382.6079	415.4142	446.2474	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)
Water heating gains (Table 5)													
	154.8727	152.1443	146.8887	135.3704	128.3151	120.9405	116.4112	120.1536	124.5412	132.7241	143.7658	153.4000	(72)
Total internal gains													
	775.5602	773.5468	749.9578	705.9699	661.0090	617.4497	593.3484	596.3757	619.0969	662.7494	711.6966	754.5155	(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	1.9600	10.6334	0.7300	0.7000	0.7700	7.3804	(74)
South	1.9600	46.7521	0.7300	0.7000	0.7700	32.4497	(78)
West	7.0700	19.6403	0.7300	0.7000	0.7700	49.1723	(80)
North	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705	(74)
East	6.7300	19.6403	0.7300	0.7000	0.7700	46.8076	(76)
South	0.6600	46.7521	0.7300	0.7000	0.7700	10.9269	(78)
West	5.5000	19.6403	0.7300	0.7000	0.7700	38.2529	(80)

Solar gains	189.9604	357.2310	563.0447	797.3941	966.3022	986.7135	940.2470	813.2065	645.7035	416.3024	234.0252	158.1643	(83)
Total gains	965.5206	1130.7778	1313.0025	1503.3639	1627.3112	1604.1632	1533.5955	1409.5822	1264.8004	1079.0518	945.7218	912.6798	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	
alpha	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	
util living area													
	0.9914	0.9822	0.9567	0.8875	0.7537	0.5777	0.4290	0.4837	0.7318	0.9331	0.9842	0.9933	(86)
MIT	19.5544	19.7787	20.1348	20.5404	20.8312	20.9597	20.9913	20.9855	20.8891	20.4766	19.9197	19.4940	(87)
Th 2	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	(88)
util rest of house													
	0.9892	0.9777	0.9458	0.8604	0.7012	0.5004	0.3377	0.3872	0.6578	0.9106	0.9794	0.9915	(89)
MIT 2	18.3483	18.6326	19.0787	19.5680	19.8886	20.0080	20.0298	20.0270	19.9533	19.5056	18.8143	18.2714	(90)
Living area fraction										fLA = Living area / (4) =		0.1478	(91)
MIT	18.5266	18.8020	19.2348	19.7118	20.0279	20.1487	20.1719	20.1687	20.0917	19.6491	18.9777	18.4521	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3766	18.6520	19.0848	19.5618	19.8779	19.9987	20.0219	20.0187	19.9417	19.4991	18.8277	18.3021	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9837	0.9687	0.9319	0.8448	0.6919	0.4975	0.3366	0.3857	0.6501	0.8947	0.9708	0.9869	(94)
Useful gains	949.7614	1095.4394	1223.6273	1269.9838	1125.9945	798.0515	516.1743	543.7119	822.2316	965.4156	918.1015	900.6805	(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	2134.8243	2085.5941	1908.5790	1616.9394	1240.2420	818.7561	518.9631	548.8047	885.9292	1349.6198	1778.5902	2138.6915	(97)
Space heating kWh	881.6868	665.3840	509.6041	249.8080	85.0001	0.0000	0.0000	0.0000	0.0000	285.8480	619.5518	921.0802	(98a)
Space heating requirement - total per year (kWh/year)												4217.9630	
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	881.6868	665.3840	509.6041	249.8080	85.0001	0.0000	0.0000	0.0000	0.0000	285.8480	619.5518	921.0802	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4217.9630	
Space heating per m2											(98c) / (4) =	29.4983	(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 %)	88.9000	(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	881.6868	665.3840	509.6041	249.8080	85.0001	0.0000	0.0000	0.0000	0.0000	285.8480	619.5518	921.0802	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	991.7737	748.4634	573.2329	280.9989	95.6132	0.0000	0.0000	0.0000	0.0000	321.5388	696.9087	1036.0857	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	238.8576	194.2131	171.3455	95.7652	40.2911	14.3364	16.2245	56.7658	104.2142	167.7210	206.4261	238.7908	(64)
Efficiency of water heater												79.9000	(216)
(217)m	86.8155	86.6937	86.4497	86.2090	85.7923	79.9000	79.9000	79.9000	79.9000	85.3452	86.4659	86.8851	(217)
Fuel for water heating, kWh/month	275.1324	224.0222	198.2025	111.0849	46.9635	17.9429	20.3060	71.0461	130.4308	196.5208	238.7370	274.8351	(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	12.8485	11.6051	12.8485	12.4340	12.8485	12.4340	12.8485	12.8485	12.4340	12.8485	12.4340	12.8485	(231)
Lighting	32.3266	25.9336	23.3503	17.1074	13.2143	10.7962	12.0545	15.6689	20.3524	26.7034	30.1614	33.2250	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.6260	-55.8498	-89.6772	-109.5000	-122.9722	-116.2352	-114.2011	-104.9723	-88.5561	-67.2251	-40.6661	-29.8893	(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	-3.0102	-7.3380	-17.4704	-30.6093	-44.2445	-45.9551	-44.8117	-35.5471	-22.9631	-11.3048	-4.2119	-2.2812	(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	4744.6153	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	1805.2241	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	65.2801	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
Total electricity for the above, kWh/year	151.2801	(231)
Electricity for lighting (calculated in Appendix L)	260.8940	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1245.1177	(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	-311.7400	(236)
Energy used	77.0400	(237)
Total delivered energy for all uses	5482.1958	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4744.6153	3.6400	172.7040	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1805.2241	3.6400	65.7102	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	151.2801	16.4900	24.9461	(249)
Energy for lighting	260.8940	16.4900	43.0214	(250)
Additional standing charges			92.0000	(251)

Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.3704	16.4900	-160.8386	
PV Unit electricity exported	-269.7473	5.5900	-15.0789	
Total			-175.9175	(252)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	3.6400	-11.3473	(253)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	16.4900	12.7039	(254)
Total energy cost			223.8208	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4286	(257)
SAP value		93.0521	
SAP rating (Section 12)		93	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4744.6153	0.2100	996.3692	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1805.2241	0.2100	379.0971	(264)
Space and water heating			1375.4663	(265)
Pumps, fans and electric keep-hot	151.2801	0.1387	20.9844	(267)
Energy for lighting	260.8940	0.1443	37.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-975.3704	0.1330	-129.6949	
PV Unit electricity exported	-269.7473	0.1223	-32.9793	
Total			-162.6742	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1232.3136	(272)
CO2 emissions per m2			8.6200	(273)
EI value			91.2160	
EI rating			91	(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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0288	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2288	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1945	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.2285	0.2237	0.2188	0.1994	0.1945	0.1702	0.1653	0.1653	0.1799	0.1945	0.1945	0.2091	(22b)

Mechanical extract ventilation - decentralised		
If mechanical ventilation	0.5000	(23a)

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28209.3538 (34)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.2820 (35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3	Sill	16.5600	0.0310	0.5134
E4	Jamb	49.9500	0.0360	1.7982
E5	Ground floor (normal)	36.8100	0.0590	2.1718
E6	Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4	Jamb	4.6500	0.0470	0.2186
E4	Jamb	4.2000	0.0670	0.2814
E4	Jamb	3.0000	0.0830	0.2490
E12	Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10	Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12	Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16	Corner (normal)	24.3500	0.0520	1.2662
E17	Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1321 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 94.4259 (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	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	(38)
Heat transfer coeff	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	(39)
Average = Sum(39)m / 12 =												151.6572	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	(40)
HLP (average)												1.0606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9226 (42)

Hot water usage for mixer showers	73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412 (42a)
Hot water usage for baths	31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041 (42b)
Hot water usage for other uses	44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601 (42c)
Average daily hot water use (litres/day)												137.3255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3400	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7236	(55)
Total storage loss	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(56)
If cylinder contains dedicated solar storage	22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	282.2957	249.4625	264.4309	230.9590	222.8706	199.7122	196.2346	204.6085	207.5093	232.7362	249.1384	279.0004	(62)
WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975	(63a)
PV diverter	-13.8091	-28.3028	-66.1939	-117.7213	-163.3551	-183.4374	-173.2393	-140.5195	-92.0103	-45.5943	-18.3602	-9.8582	(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	235.8854	192.3269	168.0450	88.2375	36.2163	0.0000	4.3072	44.2161	94.8710	162.8239	203.2287	237.1448	(64)
									Total per year (kWh/year) = Sum(64)m =			1467.3026	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
									Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =			0.0000	(64a)
Heat gains from water heating, kWh/month	115.2253	102.2410	109.2852	97.4667	95.4664	87.0772	86.6099	89.3943	89.6697	98.7467	103.5114	114.1296	(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	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	(66)

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

	36.9322	32.8029	26.6771	20.1963	15.0970	12.7455	13.7719	17.9013	24.0271	30.5079	35.6072	37.9587	(67)

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

	466.8458	471.6902	459.4825	433.4937	400.6875	369.8543	349.2558	344.4114	356.6191	382.6079	415.4142	446.2474	(68)

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

	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	(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)

	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)

Water heating gains (Table 5)

	154.8727	152.1443	146.8887	135.3704	128.3151	120.9405	116.4112	120.1536	124.5412	132.7241	143.7658	153.4000	(72)

Total internal gains

	775.5602	773.5468	749.9578	705.9699	661.0090	617.4497	593.3484	596.3757	619.0969	662.7494	711.6966	754.5155	(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	1.9600	12.4405	0.7300	0.7000	0.7700	8.6347	(74)
South	1.9600	53.3164	0.7300	0.7000	0.7700	37.0059	(78)
West	7.0700	23.1469	0.7300	0.7000	0.7700	57.9516	(80)
North	1.3200	12.4405	0.7300	0.7000	0.7700	5.8152	(74)
East	6.7300	23.1469	0.7300	0.7000	0.7700	55.1647	(76)
South	0.6600	53.3164	0.7300	0.7000	0.7700	12.4612	(78)
West	5.5000	23.1469	0.7300	0.7000	0.7700	45.0826	(80)

Solar gains	222.1160	370.4325	578.0842	831.2250	979.1784	1064.0998	988.3867	867.4679	692.8954	446.6510	264.3930	177.2005	(83)
Total gains	997.6762	1143.9793	1328.0420	1537.1949	1640.1874	1681.5496	1581.7351	1463.8437	1311.9923	1109.4004	976.0896	931.7160	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	
alpha	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	
util living area	0.9905	0.9822	0.9560	0.8806	0.7449	0.5397	0.4075	0.4482	0.7142	0.9272	0.9827	0.9930	(86)
MIT	19.5689	19.7628	20.1333	20.5583	20.8409	20.9700	20.9931	20.9897	20.8996	20.4966	19.9319	19.4833	(87)
Th 2	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	(88)
util rest of house	0.9881	0.9778	0.9451	0.8525	0.6914	0.4630	0.3182	0.3534	0.6396	0.9032	0.9775	0.9913	(89)
MIT 2	18.3666	18.6122	19.0765	19.5880	19.8981	20.0153	20.0306	20.0291	19.9617	19.5286	18.8293	18.2576	(90)
Living area fraction										fLA = Living area / (4) =		0.1478	(91)
MIT	18.5444	18.7823	19.2327	19.7315	20.0375	20.1564	20.1729	20.1711	20.1003	19.6717	18.9923	18.4388	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3944	18.6323	19.0827	19.5815	19.8875	20.0064	20.0229	20.0211	19.9503	19.5217	18.8423	18.2888	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9821	0.9689	0.9312	0.8371	0.6826	0.4608	0.3173	0.3522	0.6326	0.8872	0.9685	0.9865	(94)
Useful gains	979.8606	1108.4036	1236.6326	1286.7279	1119.5369	774.8033	501.8066	515.4950	829.9512	984.2915	945.3309	919.1174	(95)
Ext temp.	4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W	2152.6754	2112.9392	1923.4258	1619.9219	1226.5304	789.5944	503.9385	518.8400	887.2468	1353.0359	1795.9711	2167.0022	(97)
Space heating kWh	872.5742	675.0479	510.9742	239.8997	79.6032	0.0000	0.0000	0.0000	0.0000	274.3458	612.4610	928.4263	(98a)
Space heating requirement - total per year (kWh/year)												4193.3323	
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	872.5742	675.0479	510.9742	239.8997	79.6032	0.0000	0.0000	0.0000	0.0000	274.3458	612.4610	928.4263	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4193.3323	
Space heating per m2											(98c) / (4) =	29.3261	(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 %)	88.9000	(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	872.5742	675.0479	510.9742	239.8997	79.6032	0.0000	0.0000	0.0000	0.0000	274.3458	612.4610	928.4263	(98)
Space heating efficiency (main heating system 1)	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)	981.5233	759.3340	574.7741	269.8534	89.5424	0.0000	0.0000	0.0000	0.0000	308.6005	688.9325	1044.3490	(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

	235.8854	192.3269	168.0450	88.2375	36.2163	0.0000	4.3072	44.2161	94.8710	162.8239	203.2287	237.1448 (64)
Efficiency of water heater												79.9000 (216)
(217)m	86.8189	86.7337	86.4890	86.2864	85.8753	79.9000	79.9000	79.9000	79.9000	85.3205	86.4732	86.9083 (217)
Fuel for water heating, kWh/month												
	271.6981	221.7442	194.2964	102.2612	42.1731	0.0000	5.3907	55.3392	118.7372	190.8378	235.0194	272.8679 (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	12.8485	11.6051	12.8485	12.4340	12.8485	12.4340	12.8485	12.8485	12.4340	12.8485	12.4340	12.8485 (231)
Lighting	32.3266	25.9336	23.3503	17.1074	13.2143	10.7962	12.0545	15.6689	20.3524	26.7034	30.1614	33.2250 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-40.9103	-57.9325	-91.9008	-112.5474	-124.1114	-120.3532	-117.0146	-108.7074	-92.7045	-71.1394	-45.2065	-33.2288 (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	-3.8359	-7.8619	-18.3872	-32.7003	-45.3764	-50.9548	-48.1220	-39.0332	-25.5584	-12.6651	-5.1001	-2.7384 (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	4716.9092 (211)
Space heating fuel - main system 2	0.0000 (213)
Space heating fuel - secondary	0.0000 (215)
Efficiency of water heater	79.9000
Water heating fuel used	1710.3652 (219)
Space cooling fuel	0.0000 (221)
Electricity for pumps and fans:	
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)	
mechanical ventilation fans (SFP = 0.1543)	65.2801 (230a)
central heating pump	41.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	151.2801 (231)
Electricity for lighting (calculated in Appendix L)	260.8940 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-1308.0907 (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	-311.7400 (236)
Energy used	77.0400 (237)
Total delivered energy for all uses	5296.6579 (238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4716.9092	6.1900	291.9767	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1710.3652	6.1900	105.8716	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	151.2801	25.1600	38.0621	(249)
Energy for lighting	260.8940	25.1600	65.6409	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1015.7570	25.1600	-255.5644	
PV Unit electricity exported	-292.3337	5.8100	-16.9846	
Total			-272.5490	(252)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	6.1900	-19.2967	(253)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	25.1600	19.3833	(254)
Total energy cost			331.0888	(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	4716.9092	0.2100	990.5509	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1710.3652	0.2100	359.1767	(264)
Space and water heating			1349.7276	(265)
Pumps, fans and electric keep-hot	151.2801	0.1387	20.9844	(267)
Energy for lighting	260.8940	0.1443	37.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1015.7570	0.1332	-135.3090	
PV Unit electricity exported	-292.3337	0.1223	-35.7392	
Total			-171.0482	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1198.2010	(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	4716.9092	1.1300	5330.1074	(275)
Total CO2 associated with community systems			0.0000	(473)

Water heating (other fuel)	1710.3652	1.1300	1932.7127	(278)
Space and water heating			7262.8201	(279)
Pumps, fans and electric keep-hot	151.2801	1.5128	228.8566	(281)
Energy for lighting	260.8940	1.5338	400.1679	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1015.7570	1.4922	-1515.7529	
PV Unit electricity exported	-292.3337	0.4485	-131.1218	
Total			-1646.8748	(283)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	1.1300	-352.2662	(284)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	1.5010	115.6370	(285)
Total Primary energy kWh/year			6008.3407	(286)

SAP 10 EPC IMPROVEMENTS

1

Current energy efficiency rating: A 93
Current environmental impact rating: B 91

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 32	-72 kg (6.0%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£32	0.51 kg/m²	A 94	A 92
Total Savings	£32	0.51 kg/m²		

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 538 TEST (29 Feb 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£104	£124	-£20
Mains gas	£500	£517	-£18
Space heating	£432	£455	-£23
Water heating	£106	£121	-£15
Lighting	£66	£66	£0
Generated (PV)	-£273	-£342	£70
Special feature (App.Q) net	-£0	-£0	£0
Total cost of fuels	£331	£299	£32
Total cost of uses	£331	£300	£32
Delivered energy	37 kWh/m²	31 kWh/m²	6 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.1 tonnes	0.1 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	1 kg/m²
Primary energy	42 kWh/m²	41 kWh/m²	1 kWh/m²

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400 (1b)	x	2.3000 (2b)	=	169.8320	(1b) - (3b)
First floor	69.1500 (1c)	x	2.5600 (2c)	=	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	346.8560	(5)

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2. Ventilation rate

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	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	1 * 10 =	10.0000 (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) =	10.0000 / (5) =	0.0288 (8)
Pressure test		Yes

Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2288	(18)
Number of sides sheltered	2	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.1945	(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	0.2480	0.2431	0.2383	0.2140	0.2091	0.1848	0.1848	0.1799	0.1945	0.2091	0.2188	0.2285	(22b)

Mechanical extract ventilation - decentralised

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

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) =	28209.3538	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	197.2820	(35)

List of Thermal Bridges

	K1 Element	Length	Psi-value	Total
E2	Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3	Sill	16.5600	0.0310	0.5134
E4	Jamb	49.9500	0.0360	1.7982
E5	Ground floor (normal)	36.8100	0.0590	2.1718
E6	Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4	Jamb	4.6500	0.0470	0.2186
E4	Jamb	4.2000	0.0670	0.2814
E4	Jamb	3.0000	0.0830	0.2490
E12	Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10	Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12	Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16	Corner (normal)	24.3500	0.0520	1.2662
E17	Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1321	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	94.4259	(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	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	(38)
Heat transfer coeff	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	(39)

Average = Sum(39)m / 12 =	151.6572

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	(40)
HLP (average)												1.0606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9226	(42)

Hot water usage for mixer showers

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)

Hot water usage for baths

31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)

Hot water usage for other uses

44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)

Average daily hot water use (litres/day)	137.3255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)

Water storage loss:		
Store volume	190.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3400	(48)
Temperature factor from Table 2b	0.5400	(49)
Enter (49) or (54) in (55)	0.7236	(55)

Total storage loss

22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(56)

If cylinder contains dedicated solar storage

13.5770	12.2631	13.5770	13.1391	13.5770	13.1391	13.5770	13.5770	13.1391	13.5770	13.1391	13.5770	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

273.4411	241.4649	254.1806	215.6364	201.2217	178.5366	174.3530	183.6574	193.5375	222.4859	240.5694	270.1459	(62)

WWHRS	-32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975	(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)
If combined cylinder, total volume of cylinder												190.0000	(H13)
Effective solar volume												109.5000	(H14)
Reference volume												225.0000	(H15)
Storage tank correction coefficient												1.1973	(H16)
Heat delivered to hot water												636.7969	(H24)
Heat delivered to space heating												0.0000	(H29)
Solar input												636.7969	
Solar input	-0.0000	-19.6806	-61.2157	-81.8573	-104.4058	-95.9783	-95.2224	-84.5160	-60.3058	-32.5497	-1.0652	-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													
	240.8399	192.9514	162.7729	108.7789	73.5167	62.6209	60.4425	79.2686	112.6037	165.6181	211.9548	238.1484	(64)
											Total per year (kWh/year) = Sum(64)m =	1709.5166	(64)
Electric shower(s)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
											Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =	0.0000	(64a)
Heat gains from water heating, kWh/month													
	108.1416	95.8428	101.0850	85.2087	78.1473	70.1366	69.1047	72.6334	78.4922	90.5465	96.6562	107.0459	(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	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	36.9322	32.8029	26.6771	20.1963	15.0970	12.7455	13.7719	17.9013	24.0271	30.5079	35.6072	37.9587	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	466.8458	471.6902	459.4825	433.4937	400.6875	369.8543	349.2558	344.4114	356.6191	382.6079	415.4142	446.2474	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	(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)													
	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)
Water heating gains (Table 5)													
	145.3516	142.6232	135.8669	118.3454	105.0367	97.4120	92.8827	97.6256	109.0170	121.7023	134.2447	143.8789	(72)
Total internal gains													
	766.0391	764.0258	738.9359	688.9448	637.7306	593.9212	569.8199	573.8478	603.5727	651.7276	702.1756	744.9944	(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	1.9600	10.6334	0.7300	0.7000	0.7700	7.3804	(74)
South	1.9600	46.7521	0.7300	0.7000	0.7700	32.4497	(78)
West	7.0700	19.6403	0.7300	0.7000	0.7700	49.1723	(80)
North	1.3200	10.6334	0.7300	0.7000	0.7700	4.9705	(74)
East	6.7300	19.6403	0.7300	0.7000	0.7700	46.8076	(76)
South	0.6600	46.7521	0.7300	0.7000	0.7700	10.9269	(78)
West	5.5000	19.6403	0.7300	0.7000	0.7700	38.2529	(80)

Solar gains	189.9604	357.2310	563.0447	797.3941	966.3022	986.7135	940.2470	813.2065	645.7035	416.3024	234.0252	158.1643	(83)
Total gains	955.9996	1121.2568	1301.9807	1486.3389	1604.0328	1580.6347	1510.0669	1387.0542	1249.2761	1068.0299	936.2007	903.1588	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	
alpha	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	
util living area													
	0.9918	0.9827	0.9579	0.8909	0.7603	0.5849	0.4353	0.4909	0.7376	0.9352	0.9847	0.9935	(86)
MIT	19.5460	19.7706	20.1265	20.5312	20.8249	20.9577	20.9908	20.9846	20.8854	20.4692	19.9116	19.4855	(87)
Th 2	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	(88)
util rest of house													
	0.9896	0.9784	0.9472	0.8643	0.7082	0.5071	0.3428	0.3933	0.6640	0.9132	0.9801	0.9919	(89)
MIT 2	18.3377	18.6225	19.0686	19.5577	19.8826	20.0067	20.0296	20.0266	19.9503	19.4971	18.8041	18.2606	(90)
Living area fraction									fLA = Living area / (4) =			0.1478	(91)
MIT	18.5163	18.7923	19.2250	19.7016	20.0219	20.1473	20.1717	20.1683	20.0886	19.6408	18.9678	18.4417	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3663	18.6423	19.0750	19.5516	19.8719	19.9973	20.0217	20.0183	19.9386	19.4908	18.8178	18.2917	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9696	0.9335	0.8486	0.6987	0.5041	0.3417	0.3917	0.6560	0.8974	0.9717	0.9873	(94)
Useful gains	940.9163	1087.1443	1215.4095	1261.3263	1120.6607	796.7491	515.9615	543.3214	819.4903	958.4058	909.7312	891.7118	(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													
	2133.2612	2084.1117	1907.0940	1615.3943	1239.3341	818.5378	518.9245	548.7352	885.4600	1348.3503	1777.0955	2137.1116	(97)
Space heating kWh													
	887.1046	669.9621	514.6132	254.9289	88.2930	0.0000	0.0000	0.0000	0.0000	290.1187	624.5023	926.5775	(98a)
Space heating requirement - total per year (kWh/year)												4256.1003	

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

887.1046	669.9621	514.6132	254.9289	88.2930	0.0000	0.0000	0.0000	0.0000	290.1187	624.5023	926.5775	(98c)

Space heating requirement after solar contribution - total per year (kWh/year) 4256.1003

Space heating per m2 (98c) / (4) = 29.7650 (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 %) 88.9000 (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													
	887.1046	669.9621	514.6132	254.9289	88.2930	0.0000	0.0000	0.0000	0.0000	290.1187	624.5023	926.5775	(98)
Space heating efficiency (main heating system 1)													
	88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system)													
	997.8679	753.6131	578.8675	286.7592	99.3172	0.0000	0.0000	0.0000	0.0000	326.3427	702.4773	1042.2694	(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													
	240.8399	192.9514	162.7729	108.7789	73.5167	62.6209	60.4425	79.2686	112.6037	165.6181	211.9548	238.1484	(64)
Efficiency of water heater												79.9000	(216)
(217)m	86.8121	86.7159	86.5572	86.0027	84.5718	79.9000	79.9000	79.9000	79.9000	85.4040	86.4330	86.8986	(217)
Fuel for water heating, kWh/month													
	277.4267	222.5099	188.0525	126.4832	86.9281	78.3741	75.6477	99.2097	140.9308	193.9230	245.2244	274.0531	(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	19.6430	17.7420	19.6430	19.0093	19.6430	19.0093	19.6430	19.6430	19.0093	19.6430	19.0093	19.6430	(231)
Lighting	32.3266	25.9336	23.3503	17.1074	13.2143	10.7962	12.0545	15.6689	20.3524	26.7034	30.1614	33.2250	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-35.7308	-56.0856	-90.2057	-110.3859	-124.2416	-117.6063	-115.6051	-106.1490	-89.3511	-67.6356	-40.8227	-29.9729	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-14.9464	-36.4541	-86.8234	-152.1609	-219.9532	-228.4046	-222.6544	-176.5590	-114.0204	-56.1133	-20.9028	-11.3222	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)

Annual totals kWh/year

Space heating fuel - main system 1 4787.5143 (211)

Space heating fuel - main system 2 0.0000 (213)

Space heating fuel - secondary 0.0000 (215)

Efficiency of water heater 79.9000

Water heating fuel used 2008.7632 (219)

Space cooling fuel 0.0000 (221)

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)

mechanical ventilation fans (SFP = 0.1543) 65.2801 (230a)

central heating pump 41.0000 (230c)

main heating flue fan 45.0000 (230e)

pump for solar water heating 80.0000 (230g)

Total electricity for the above, kWh/year 231.2801 (231)

Electricity for lighting (calculated in Appendix L) 260.8940 (232)

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

PV generation -2324.1069 (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 -311.7400 (236)

Energy used 77.0400 (237)

Total delivered energy for all uses 4729.6449 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4787.5143	3.6400	174.2655	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2008.7632	3.6400	73.1190	(247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000	(247a)
Pumps, fans and electric keep-hot	151.2801	16.4900	24.9461	(249)
Pump for solar water heating	80.0000	16.4900	13.1920	(249)
Energy for lighting	260.8940	16.4900	43.0214	(250)
Additional standing charges			92.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-983.7923	16.4900	-162.2273	
PV Unit electricity exported	-1340.3146	5.5900	-74.9236	
Total			-237.1509	(252)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	3.6400	-11.3473	(253)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	16.4900	12.7039	(254)
Total energy cost			184.7496	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3538 (257)
SAP value		94.2650
SAP rating (Section 12)		94 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4787.5143	0.2100	1005.3780	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2008.7632	0.2100	421.8403	(264)
Space and water heating			1427.2183	(265)
Pumps, fans and electric keep-hot	231.2801	0.1387	32.0814	(267)
Energy for lighting	260.8940	0.1443	37.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-983.7923	0.1329	-130.7671	
PV Unit electricity exported	-1340.3146	0.1223	-163.8684	
Total			-294.6355	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1163.2013	(272)
CO2 emissions per m2			8.1300	(273)
EI value			91.7087	
EI rating			92	(274)
EI band			A	

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.8400	(1b)	x 2.3000	(2b) =	169.8320	(1b) - (3b)
First floor	69.1500	(1c)	x 2.5600	(2c) =	177.0240	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	142.9900					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		346.8560	(5)

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2. Ventilation rate

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		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0288	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2288	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1945	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.7000	4.6000	4.5000	4.1000	4.0000	3.5000	3.4000	3.4000	3.7000	4.0000	4.0000	4.3000	(22)
Wind factor	1.1750	1.1500	1.1250	1.0250	1.0000	0.8750	0.8500	0.8500	0.9250	1.0000	1.0000	1.0750	(22a)
Adj infilt rate	0.2285	0.2237	0.2188	0.1994	0.1945	0.1702	0.1653	0.1653	0.1799	0.1945	0.1945	0.2091	(22b)

Mechanical extract ventilation - decentralised

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

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

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3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Front Door			2.3700	1.2000	2.8440			(26)
Rear Door			2.0000	1.3000	2.6000			(26a)
French door (Uw = 1.30)			10.9900	1.2357	13.5808			(27)
Window (Uw = 1.30)			14.2100	1.2357	17.5599			(27)
225mm TE Platinum GF B&B			73.8400	0.1100	8.1224	135.0000	9968.4000	(28a)
Full Fill Bead	171.5600	29.5700	141.9900	0.2300	32.6577	60.0000	8519.3999	(29a)
500mm MW @ 0.044	69.1500		69.1500	0.0900	6.2235	10.0000	691.5000	(30)
Lightpod Roof	4.1500		4.1500	0.1700	0.7055	9.0000	37.3500	(30)
Total net area of external elements Aum(A, m2)			318.7000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	84.2938			(33)
GF Solid			75.5000			75.0000	5662.5000	(32c)
GF Timber			42.9100			7.7000	330.4070	(32c)
FF Timber			147.1100			7.7000	1132.7470	(32c)
FF Floor			69.1500			18.0000	1244.7000	(32d)
GF Ceiling			69.1500			9.0000	622.3500	(32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 28209.3538 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 197.2820 (35)
List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	18.5300	0.0260	0.4818
E3 Sill	16.5600	0.0310	0.5134
E4 Jamb	49.9500	0.0360	1.7982
E5 Ground floor (normal)	36.8100	0.0590	2.1718
E6 Intermediate floor within a dwelling	34.0100	0.0060	0.2041
E4 Jamb	4.6500	0.0470	0.2186
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	3.0000	0.0830	0.2490
E12 Gable (insulation at ceiling level)	17.5300	0.1030	1.8056
E10 Eaves (insulation at ceiling level)	18.7100	0.0740	1.3845
E12 Gable (insulation at ceiling level)	3.7800	0.0570	0.2155
E16 Corner (normal)	24.3500	0.0520	1.2662
E17 Corner (inverted - internal area greater than external area)	4.8700	-0.0940	-0.4578

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.1321 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 94.4259 (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	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	57.2312	(38)
Heat transfer coeff	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	151.6572	(39)
Average = Sum(39)m / 12 =												151.6572	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	1.0606	(40)
HLP (average)												1.0606	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9226 (42)
Hot water usage for mixer showers

73.2218	72.1214	70.5179	67.4500	65.1859	62.6610	61.2259	62.8172	64.5616	67.2726	70.4064	72.9412	(42a)

Hot water usage for baths

31.6110	31.1415	30.4804	29.2614	28.3487	27.3366	26.7899	27.4464	28.1612	29.2442	30.4882	31.5041	(42b)

Hot water usage for other uses

44.5601	42.9397	41.3193	39.6990	38.0786	36.4582	36.4582	38.0786	39.6990	41.3193	42.9397	44.5601	(42c)

Average daily hot water use (litres/day) 137.3255 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	149.3928	146.2026	142.3176	136.4104	131.6132	126.4558	124.4740	128.3422	132.4218	137.8361	143.8343	149.0054	(44)
Energy conte	236.6017	208.1905	218.7369	186.7390	177.1766	155.4922	150.5406	158.9145	163.2893	187.0422	204.9184	233.3064	(45)
Energy content (annual)										Total = Sum(45)m =		2280.9483	
Distribution loss (46)m = 0.15 x (45)m	35.4903	31.2286	32.8105	28.0108	26.5765	23.3238	22.5811	23.8372	24.4934	28.0563	30.7378	34.9960	(46)

Water storage loss:
Store volume 190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3400 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7236 (55)
Total storage loss

22.4316	20.2608	22.4316	21.7080	22.4316	21.7080	22.4316	22.4316	21.7080	22.4316	21.7080	22.4316	(56)

If cylinder contains dedicated solar storage

13.5770	12.2631	13.5770	13.1391	13.5770	13.1391	13.5770	13.5770	13.1391	13.5770	13.1391	13.5770	(57)
Primary loss 23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month												
273.4411	241.4649	254.1806	215.6364	201.2217	178.5366	174.3530	183.6574	193.5375	222.4859	240.5694	270.1459	(62)
WWHRS -32.6012	-28.8328	-30.1920	-25.0002	-23.2993	-19.9374	-18.6881	-19.8729	-20.6280	-24.3181	-27.5495	-31.9975	(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)
If combined cylinder, total volume of cylinder											190.0000	(H13)
Effective solar volume											109.5000	(H14)
Reference volume											225.0000	(H15)
Storage tank correction coefficient											1.1973	(H16)
Heat delivered to hot water											683.7167	(H24)
Heat delivered to space heating											0.0000	(H29)
Solar input											683.7167	
Solar input -2.7927	-21.2753	-63.2282	-85.8778	-105.7650	-103.6567	-100.1413	-90.9146	-66.3175	-37.4437	-6.3040	-0.0000	(63c)
FGHRS 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
238.0471	191.3568	160.7604	104.7585	72.1575	54.9425	55.5236	72.8699	106.5920	160.7241	206.7160	238.1484	(64)
									Total per year (kWh/year) = Sum(64)m =		1662.5968	(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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
108.1416	95.8428	101.0850	85.2087	78.1473	70.1366	69.1047	72.6334	78.4922	90.5465	96.6562	107.0459	(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 175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	175.3543	(66)

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

36.9322	32.8029	26.6771	20.1963	15.0970	12.7455	13.7719	17.9013	24.0271	30.5079	35.6072	37.9587	(67)

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

466.8458	471.6902	459.4825	433.4937	400.6875	369.8543	349.2558	344.4114	356.6191	382.6079	415.4142	446.2474	(68)

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

55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	55.4580	(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)

-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	-116.9029	(71)

Water heating gains (Table 5)

145.3516	142.6232	135.8669	118.3454	105.0367	97.4120	92.8827	97.6256	109.0170	121.7023	134.2447	143.8789	(72)

Total internal gains

766.0391	764.0258	738.9359	688.9448	637.7306	593.9212	569.8199	573.8478	603.5727	651.7276	702.1756	744.9944	(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	1.9600	12.4405	0.7300	0.7000	0.7700	8.6347	(74)
South	1.9600	53.3164	0.7300	0.7000	0.7700	37.0059	(78)
West	7.0700	23.1469	0.7300	0.7000	0.7700	57.9516	(80)
North	1.3200	12.4405	0.7300	0.7000	0.7700	5.8152	(74)
East	6.7300	23.1469	0.7300	0.7000	0.7700	55.1647	(76)
South	0.6600	53.3164	0.7300	0.7000	0.7700	12.4612	(78)
West	5.5000	23.1469	0.7300	0.7000	0.7700	45.0826	(80)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains 222.1160	370.4325	578.0842	831.2250	979.1784	1064.0998	988.3867	867.4679	692.8954	446.6510	264.3930	177.2005	(83)
Total gains 988.1552	1134.4583	1317.0201	1520.1698	1616.9090	1658.0210	1558.2066	1441.3157	1296.4680	1098.3786	966.5685	922.1949	(84)

7. Mean internal temperature (heating season)

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

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau 51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	51.6687	
alpha 4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	4.4446	
util living area 0.9909	0.9828	0.9572	0.8841	0.7516	0.5464	0.4134	0.4547	0.7199	0.9294	0.9833	0.9933	(86)
MIT 19.5606	19.7548	20.1251	20.5494	20.8349	20.9685	20.9927	20.9891	20.8962	20.4894	19.9239	19.4748	(87)
Th 2 20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	20.0331	(88)
util rest of house 0.9885	0.9785	0.9465	0.8564	0.6984	0.4691	0.3229	0.3587	0.6455	0.9059	0.9783	0.9916	(89)
MIT 2 18.3560	18.6022	19.0665	19.5781	19.8926	20.0144	20.0304	20.0289	19.9590	19.5203	18.8192	18.2469	(90)
Living area fraction								fLA = Living area / (4) =			0.1478	(91)
MIT 18.5341	18.7726	19.2230	19.7217	20.0319	20.1554	20.1727	20.1708	20.0976	19.6636	18.9825	18.4284	(92)
Temperature adjustment											-0.1500	
adjusted MIT 18.3841	18.6226	19.0730	19.5717	19.8819	20.0054	20.0227	20.0208	19.9476	19.5136	18.8325	18.2784	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0.9827	0.9697	0.9327	0.8409	0.6893	0.4668	0.3219	0.3575	0.6383	0.8900	0.9695	0.9870	(94)
Useful gains 971.0745	1100.1033	1228.4417	1278.3775	1114.4961	773.8845	501.6468	515.2416	827.5098	977.5083	937.0426	910.1635	(95)
Ext temp. 4.2000	4.7000	6.4000	8.9000	11.8000	14.8000	16.7000	16.6000	14.1000	10.6000	7.0000	4.0000	(96)
Heat loss rate W 2151.1205	2111.4560	1921.9456	1618.4355	1225.6747	789.4402	503.9092	518.7941	886.8307	1351.8088	1794.4891	2165.4243	(97)
Space heating kWh 877.9542	679.6291	515.9669	244.8417	82.7169	0.0000	0.0000	0.0000	0.0000	278.4796	617.3615	933.9140	(98a)
Space heating requirement - total per year (kWh/year)											4230.8639	
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 877.9542	679.6291	515.9669	244.8417	82.7169	0.0000	0.0000	0.0000	0.0000	278.4796	617.3615	933.9140	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											4230.8639	
Space heating per m2										(98c) / (4) =	29.5885	(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 %)	88.9000 (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 877.9542	679.6291	515.9669	244.8417	82.7169	0.0000	0.0000	0.0000	0.0000	278.4796	617.3615	933.9140	(98)
Space heating efficiency (main heating system 1) 88.9000	88.9000	88.9000	88.9000	88.9000	0.0000	0.0000	0.0000	0.0000	88.9000	88.9000	88.9000	(210)
Space heating fuel (main heating system) 987.5750	764.4871	580.3903	275.4125	93.0449	0.0000	0.0000	0.0000	0.0000	313.2504	694.4449	1050.5220	(211)

Space heating efficiency (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	238.0471	191.3568	160.7604	104.7585	72.1575	54.9425	55.5236	72.8699	106.5920	160.7241	206.7160	238.1484	(64)
Efficiency of water heater												79.9000	(216)
(217)m	86.8141	86.7531	86.5832	85.9973	84.4671	79.9000	79.9000	79.9000	79.9000	85.3806	86.4571	86.9109	(217)
Fuel for water heating, kWh/month													
	274.2032	220.5763	185.6717	121.8160	85.4267	68.7641	69.4914	91.2014	133.4068	188.2443	239.0965	274.0145	(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	19.6430	17.7420	19.6430	19.0093	19.6430	19.0093	19.6430	19.6430	19.0093	19.6430	19.0093	19.6430	(231)
Lighting	32.3266	25.9336	23.3503	17.1074	13.2143	10.7962	12.0545	15.6689	20.3524	26.7034	30.1614	33.2250	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-41.0417	-58.1833	-92.4530	-113.4816	-125.4055	-121.8331	-118.4949	-109.9721	-93.5720	-71.5928	-45.3932	-33.3280	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-19.0479	-39.0587	-91.3838	-162.5675	-225.5879	-253.2943	-239.1298	-193.9013	-126.9246	-62.8721	-25.3136	-13.5927	(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	4759.1270	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	79.9000	
Water heating fuel used	1951.9128	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 6.9420, total flow = 45.0000, SFP = 0.1543)		
mechanical ventilation fans (SFP = 0.1543)	65.2801	(230a)
central heating pump	41.0000	(230c)
main heating flue fan	45.0000	(230e)
pump for solar water heating	80.0000	(230g)
Total electricity for the above, kWh/year	231.2801	(231)
Electricity for lighting (calculated in Appendix L)	260.8940	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2477.4255	(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	-311.7400	(236)
Energy used	77.0400	(237)
Total delivered energy for all uses	4491.0884	(238)

10a. Fuel costs - using BEDF prices (538)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4759.1270	6.1900	294.5900	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1951.9128	6.1900	120.8234	(247)
Energy for instantaneous electric shower(s)	0.0000	25.1600	0.0000	(247a)
Pumps, fans and electric keep-hot	151.2801	25.1600	38.0621	(249)
Pump for solar water heating	80.0000	25.1600	20.1280	(249)
Energy for lighting	260.8940	25.1600	65.6409	(250)
Additional standing charges			102.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.7512	25.1600	-257.8274	
PV Unit electricity exported	-1452.6743	5.8100	-84.4004	
Total			-342.2278	(252)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	6.1900	-19.2967	(253)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	25.1600	19.3833	(254)
Total energy cost			299.1032	(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	4759.1270	0.2100	999.4167	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1951.9128	0.2100	409.9017	(264)
Space and water heating			1409.3184	(265)
Pumps, fans and electric keep-hot	231.2801	0.1387	32.0814	(267)
Energy for lighting	260.8940	0.1443	37.6551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.7512	0.1332	-136.4549	
PV Unit electricity exported	-1452.6743	0.1223	-177.5962	
Total			-314.0510	(269)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	0.2100	-65.4654	(270)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	0.1360	10.4774	(271)
Appendix Q item 'PV Diverter - Part 2' - energy saved	-0.0000	0.0000	-0.0000	(270)
Appendix Q item 'PV Diverter - Part 2' - energy used	15.8700	0.0000	15.8700	(271)
Total CO2, kg/year			1125.8859	(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	4759.1270	1.1300	5377.8135	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1951.9128	1.1300	2205.6615	(278)
Space and water heating			7583.4750	(279)
Pumps, fans and electric keep-hot	231.2801	1.5128	349.8806	(281)
Energy for lighting	260.8940	1.5338	400.1679	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1024.7512	1.4920	-1528.9779	
PV Unit electricity exported	-1452.6743	0.4485	-651.5755	
Total			-2180.5534	(283)
Appendix Q item 'PV Diverter - Part 1' - energy saved	-311.7400	1.1300	-352.2662	(284)
Appendix Q item 'PV Diverter - Part 1' - energy used	77.0400	1.5010	115.6370	(285)
Total Primary energy kWh/year			5916.3409	(286)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

ENVIRONMENTAL ECONOMICS

Property Reference	Plot 096 H469 Det	**Issued on Date**	19/03/2024
Assessment Reference	1	**Prop Type Ref**	
Property	Plot 096, White Post Road, Bodicote, OX15		

SAP Rating	85 B	**DER**	15.33	**TER**	15.89
Environmental	86 B	**% DER<TER**	3.55		
CO_2 Emissions (t/year)	1.98	**DFEE**	49.68	**TFEE**	55.63
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.70		

Assessor Details	Mr. Thomas Ferrett, Thomas Ferrett, Tel: 01582 544250, tom.ferrett@ee-ltd.co.uk	**Assessor ID**	Q141-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Detached House, total floor area 141 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 15.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.33 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.17 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.50 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.27 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.21 m², No overhang
Windows facing East: 12.43 m², No overhang
Windows facing South: 2.55 m², No overhang
Windows facing West: 7.58 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.034 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.3700 (1b)	x	2.3000 (2b)	=	166.4510	(1b) - (3b)
First floor	68.3300 (1c)	x	2.5600 (2c)	=	174.9248	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	341.3758	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3677	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2849	(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	0.3633	0.3562	0.3491	0.3134	0.3063	0.2707	0.2707	0.2636	0.2849	0.3063	0.3206	0.3348	(22b)
Effective ac	0.5660	0.5634	0.5609	0.5491	0.5469	0.5366	0.5366	0.5347	0.5406	0.5469	0.5514	0.5560	(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	
Opening Type 1 (Uw = 1.41)			25.7700	1.3347	34.3958			(27)
Opening Type 2			4.3800	1.5000	6.5700			(26a)
150mm TE Platinum GF			72.9600	0.1400	10.2144			(28a)
50mm TE Plat Stone	169.9300	30.1500	139.7800	0.2800	39.1384			(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1100	7.5163			(30)
Grd Floor Bays	4.0400		4.0400	0.1700	0.6868			(30)
Total net area of external elements Aum(A, m2)			315.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.5217			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	135.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7883	(36)
Total fabric heat loss (33) + (36) =	109.3100	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.7617	63.4730	63.1900	61.8609	61.6122	60.4545	60.4545	60.2402	60.9005	61.6122	62.1153	62.6412	(38)
Heat transfer coeff	173.0717	172.7830	172.5000	171.1709	170.9222	169.7645	169.7645	169.5502	170.2105	170.9222	171.4253	171.9512	(39)
Average = Sum(39)m / 12 =												171.1697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2301	1.2280	1.2260	1.2166	1.2148	1.2066	1.2066	1.2050	1.2097	1.2148	1.2184	1.2221	(40)
HLP (average)												1.2166	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9184 (42)
Average daily hot water use (litres/day)	103.5121 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8633	109.7228	105.5824	101.4419	97.3014	93.1609	93.1609	97.3014	101.4419	105.5824	109.7228	113.8633	(44)
Energy conte	168.8560	147.6826	152.3952	132.8618	127.4841	110.0091	101.9396	116.9771	118.3742	137.9537	150.5873	163.5280	(45)
Energy content (annual)										Total = Sum(45)m =		1628.6487	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3284	22.1524	22.8593	19.9293	19.1226	16.5014	15.2909	17.5466	17.7561	20.6931	22.5881	24.5292	(46)

Water storage loss:	
Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.2700 (48)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6858	(55)
Total storage loss													
	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598	(56)
If cylinder contains dedicated solar storage													
	21.2598	19.2024	21.2598	20.5740	21.2598	20.5740	21.2598	21.2598	20.5740	21.2598	20.5740	21.2598	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	213.3782	187.8962	196.9174	175.9478	172.0063	153.0951	146.4618	161.4993	161.4602	182.4759	193.6733	208.0502	(62)
WWHRS	-30.9159	-27.2031	-27.7637	-22.8360	-21.1999	-17.4863	-14.7945	-17.9143	-18.4390	-22.7994	-26.4171	-29.8832	eq.(G10)
Total of WWHRS savings												-277.6522	
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	182.4623	160.6931	169.1537	153.1118	150.8063	135.6088	131.6673	143.5851	143.0212	159.6765	167.2562	178.1670	(64)
								Total per year (kWh/year) = Sum(64)m =				1875.2094	(64)
Heat gains from water heating, kWh/month													
	91.7624	81.2753	86.2892	78.6454	78.0062	71.0468	69.5127	74.5127	73.8282	81.4874	84.5391	89.9908	(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	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	28.1693	25.0197	20.3474	15.4043	11.5149	9.7214	10.5043	13.6538	18.3262	23.2693	27.1587	28.9522	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	310.2065	313.4255	305.3138	288.0449	266.2461	245.7582	232.0711	228.8521	236.9638	254.2327	276.0315	296.5194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	(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)													
	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	(71)
Water heating gains (Table 5)													
	123.3365	120.9454	115.9800	109.2297	104.8471	98.6761	93.4310	100.1514	102.5392	109.5260	117.4154	120.9554	(72)
Total internal gains													
	531.4884	529.1667	511.4173	482.4549	452.3841	423.9318	405.7824	412.4335	427.6053	456.8041	490.3817	516.2031	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2100	10.6334	0.7100	0.7000	0.7700	11.7562	(74)
East	12.4300	19.6403	0.7100	0.7000	0.7700	84.0830	(76)
South	2.5500	46.7521	0.7100	0.7000	0.7700	41.0611	(78)
West	7.5800	19.6403	0.7100	0.7000	0.7700	51.2751	(80)

Solar gains	188.1753	354.5032	559.9076	794.1188	962.9129	983.3970	937.0350	810.1214	642.5510	413.4709	231.9497	156.5930	(83)
Total gains	719.6638	883.6699	1071.3249	1276.5738	1415.2970	1407.3288	1342.8174	1222.5549	1070.1563	870.2750	722.3314	672.7961	(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	30.5988	30.6500	30.7002	30.9386	30.9836	31.1949	31.1949	31.2344	31.1132	30.9836	30.8927	30.7982	
alpha	3.0399	3.0433	3.0467	3.0626	3.0656	3.0797	3.0797	3.0823	3.0742	3.0656	3.0595	3.0532	
util living area													
	0.9890	0.9790	0.9554	0.8987	0.7959	0.6503	0.5116	0.5692	0.7884	0.9395	0.9818	0.9910	(86)
MIT	18.7715	19.0382	19.4866	20.0513	20.5242	20.8237	20.9383	20.9134	20.6598	20.0138	19.2823	18.7219	(87)
Th 2	19.8960	19.8976	19.8992	19.9068	19.9082	19.9147	19.9147	19.9160	19.9122	19.9082	19.9053	19.9024	(88)
util rest of house													
	0.9868	0.9747	0.9461	0.8768	0.7507	0.5712	0.4019	0.4588	0.7242	0.9220	0.9774	0.9892	(89)
MIT 2	16.9158	17.3042	17.9526	18.7566	19.3959	19.7663	19.8799	19.8628	19.5892	18.7217	17.6669	16.8473	(90)
Living area fraction									fLA = Living area / (4) =			0.1472	(91)
MIT	17.1890	17.5594	18.1784	18.9472	19.5620	19.9220	20.0357	20.0174	19.7468	18.9119	17.9047	17.1232	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.0390	17.4094	18.0284	18.7972	19.4120	19.7720	19.8857	19.8674	19.5968	18.7619	17.7547	16.9732	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9774	0.9601	0.9237	0.8484	0.7266	0.5596	0.3987	0.4534	0.7018	0.8962	0.9638	0.9811	(94)
Useful gains	703.3648	848.3798	989.5699	1082.9989	1028.3571	787.5856	535.3769	554.2528	750.9949	779.9571	696.1671	660.0951	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2204.7554	2161.4148	1988.6426	1694.1047	1318.1476	878.0170	557.7917	587.8999	935.6169	1395.0416	1826.4765	2196.3754	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1117.0346	882.3595	743.3101	439.9962	215.6041	0.0000	0.0000	0.0000	0.0000	457.6228	813.8228	1142.9925	(98)
Space heating												5812.7426	(98)
Space heating per m2											(98) / (4) =	41.3130	(99)

8c. Space cooling requirement

Not applicable

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 %)	90.6000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6415.8307	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1117.0346	882.3595	743.3101	439.9962	215.6041	0.0000	0.0000	0.0000	0.0000	457.6228	813.8228	1142.9925	(98)
Space heating efficiency (main heating system 1)													
	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)													
	1232.9300	973.9067	820.4306	485.6470	237.9736	0.0000	0.0000	0.0000	0.0000	505.1025	898.2592	1261.5811	(211)
Water heating 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	(215)
Water heating													
Water heating requirement													
	182.4623	160.6931	169.1537	153.1118	150.8063	135.6088	131.6673	143.5851	143.0212	159.6765	167.2562	178.1670	(64)
Efficiency of water heater												79.9000	(216)
(217)m	88.9279	88.7686	88.4053	87.5725	85.8672	79.9000	79.9000	79.9000	79.9000	87.5667	88.5777	88.9928	(217)
Fuel for water heating, kWh/month													
	205.1802	181.0247	191.3389	174.8400	175.6274	169.7231	164.7901	179.7060	179.0002	182.3486	188.8243	200.2038	(219)
Water heating fuel used												2192.6073	(219)
Annual totals kWh/year													
Space heating fuel - main system												6415.8307	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												497.4787	(232)
Total delivered energy for all uses												9180.9166	(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	6415.8307	0.2160	1385.8194	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2192.6073	0.2160	473.6032	(264)
Space and water heating			1859.4226	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	497.4787	0.5190	258.1914	(268)
Total CO2, kg/year			2156.5390	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.3300	ZC1
Total Floor Area	TFA	140.7000	
Assumed number of occupants	N	2.9184	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.0648	ZC2
CO2 emissions from cooking, equation (L16)		1.3436	ZC3
Total CO2 emissions		29.7384	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.7384	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.3700	(1b)	x 2.3000	(2b) =	166.4510	(1b) - (3b)
First floor	68.3300	(1c)	x 2.5600	(2c) =	174.9248	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		341.3758	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3672	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2846	(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	0.3628	0.3557	0.3486	0.3130	0.3059	0.2703	0.2703	0.2632	0.2846	0.3059	0.3201	0.3344	(22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.3800	1.2000	5.2560			(26a)
TER Opening Type (Uw = 1.40)			25.7700	1.3258	34.1648			(27)
150mm TE Platinum GF			72.9600	0.1300	9.4848			(28a)
50mm TE Plat Stone	169.9300	30.1500	139.7800	0.1800	25.1604			(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1300	8.8829			(30)
Grd Floor Bays	4.0400		4.0400	0.1300	0.5252			(30)
Total net area of external elements Aum(A, m2)			315.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.4741			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.3361	(36)
Total fabric heat loss (33) + (36) =	98.8102	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.7415	63.4536	63.1714	61.8458	61.5978	60.4433	60.4433	60.2295	60.8880	61.5978	62.0995	62.6241	(38)
Heat transfer coeff	162.5517	162.2638	161.9816	160.6560	160.4080	159.2535	159.2535	159.0397	159.6982	160.4080	160.9097	161.4342	(39)
Average = Sum(39)m / 12 =												160.6548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1553	1.1533	1.1513	1.1418	1.1401	1.1319	1.1319	1.1303	1.1350	1.1401	1.1436	1.1474	(40)
HLP (average)												1.1418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9184 (42)
Average daily hot water use (litres/day)	103.5121 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8633	109.7228	105.5824	101.4419	97.3014	93.1609	93.1609	97.3014	101.4419	105.5824	109.7228	113.8633	(44)
Energy conte	168.8560	147.6826	152.3952	132.8618	127.4841	110.0091	101.9396	116.9771	118.3742	137.9537	150.5873	163.5280	(45)
Energy content (annual)										Total = Sum(45)m =		1628.6487	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3284	22.1524	22.8593	19.9293	19.1226	16.5014	15.2909	17.5466	17.7561	20.6931	22.5881	24.5292	(46)

Water storage loss:	
Store volume	180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5520 (48)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

```
  Temperature factor from Table 2b                                                                                0.5400 (49)
Enter (49) or (54) in (55)                                                                                        0.8381 (55)
Total storage loss
              25.9803    23.4661    25.9803    25.1422    25.9803    25.1422    25.9803    25.9803    25.1422    25.9803    25.1422    25.9803 (56)
If cylinder contains dedicated solar storage
              25.9803    23.4661    25.9803    25.1422    25.9803    25.1422    25.9803    25.9803    25.1422    25.9803    25.1422    25.9803 (57)
Primary loss  23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
             218.0987   192.1598   201.6378   180.5160   176.7267   157.6633   151.1822   166.2198   166.0284   187.1964   198.2415   212.7707 (62)
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 (63)
                                                                                Solar input (sum of months) = Sum(63)m =      0.0000 (63)
Output from w/h
             218.0987   192.1598   201.6378   180.5160   176.7267   157.6633   151.1822   166.2198   166.0284   187.1964   198.2415   212.7707 (64)
                                                                                  Total per year (kWh/year) = Sum(64)m =   2208.4414 (64)
Heat gains from water heating, kWh/month
              95.5388    84.6863    90.0655    82.2999    81.7826    74.7014    73.2890    78.2890    77.4828    85.2638    88.1936    93.7672 (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       145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202   145.9202 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
              28.1693    25.0197    20.3474    15.4043    11.5149     9.7214    10.5043    13.6538    18.3262    23.2693    27.1587    28.9522 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
             310.2065   313.4255   305.3138   288.0449   266.2461   245.7582   232.0711   228.8521   236.9638   254.2327   276.0315   296.5194 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
              37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920    37.5920 (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)
            -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362  -116.7362 (71)
Water heating gains (Table 5)
             128.4123   126.0212   121.0558   114.3054   109.9228   103.7519    98.5068   105.2272   107.6150   114.6018   122.4912   126.0312 (72)
Total internal gains
             536.5642   534.2425   516.4931   487.5307   457.4599   429.0076   410.8582   417.5092   432.6811   461.8799   495.4575   521.2789 (73)
```

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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                                   3.2100          10.6334          0.6300         0.7000         0.7700      10.4315 (74)
East                                   12.4300          19.6403          0.6300         0.7000         0.7700      74.6088 (76)
South                                   2.5500          46.7521          0.6300         0.7000         0.7700      36.4345 (78)
West                                    7.5800          19.6403          0.6300         0.7000         0.7700      45.4976 (80)
-------------------------------------------------------------------------------------------------------------------------

Solar gains   166.9725   314.5592   496.8194   704.6406   854.4156   872.5917   831.4536   718.8401   570.1509   366.8826   205.8145   138.9487 (83)
Total gains   703.5367   848.8017  1013.3125  1192.1714  1311.8755  1301.5993  1242.3118  1136.3494  1002.8320   828.7625   701.2720   660.2276 (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          60.1091    60.2157    60.3207    60.8184    60.9124    61.3540    61.3540    61.4364    61.1831    60.9124    60.7225    60.5252
alpha         5.0073     5.0144     5.0214     5.0546     5.0608     5.0903     5.0903     5.0958     5.0789     5.0608     5.0482     5.0350
util living area
              0.9991     0.9976     0.9916     0.9655     0.8837     0.7199     0.5503     0.6177     0.8722     0.9852     0.9980     0.9994 (86)

MIT          19.6585    19.8221    20.1031    20.4700    20.7777    20.9449    20.9886    20.9801    20.8479    20.4304    19.9730    19.6295 (87)
Th 2         19.9559    19.9576    19.9592    19.9668    19.9682    19.9749    19.9749    19.9761    19.9723    19.9682    19.9654    19.9623 (88)
util rest of house
              0.9988     0.9967     0.9885     0.9520     0.8395     0.6287     0.4292     0.4930     0.8063     0.9773     0.9972     0.9992 (89)
MIT 2        18.1567    18.3970    18.8073    19.3373    19.7479    19.9380    19.9707    19.9678    19.8456    19.2897    18.6236    18.1187 (90)
Living area fraction                                                                                fLA = Living area / (4) =      0.1472 (91)
MIT          18.3777    18.6067    18.9980    19.5040    19.8995    20.0862    20.1205    20.1168    19.9932    19.4576    18.8222    18.3411 (92)
Temperature adjustment                                                                                          0.0000
adjusted MIT 18.3777    18.6067    18.9980    19.5040    19.8995    20.0862    20.1205    20.1168    19.9932    19.4576    18.8222    18.3411 (93)
```

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8. Space heating requirement

```
                Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation   0.9981     0.9950     0.9843     0.9442     0.8361     0.6394     0.4469     0.5111     0.8079     0.9717     0.9957     0.9986 (94)
Useful gains 702.2087   844.5982   997.3983  1125.5985  1096.8357   832.2823   555.2484   580.7811   810.1581   805.3024   698.2807   659.3179 (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
             2288.3601  2224.1054  2024.4507  1703.6002  1315.2675   873.6952   560.6506   591.1217   941.1262  1420.8350  1886.2202  2282.8535 (97)
Month fracti   1.0000     1.0000     1.0000     1.0000     1.0000     0.0000     0.0000     0.0000     0.0000     1.0000     1.0000     1.0000 (97a)
Space heating kWh
             1180.0966   927.0288   764.1270   416.1612   162.5132     0.0000     0.0000     0.0000     0.0000   457.9563   855.3165  1207.9105 (98)
Space heating                                                                                                  5971.1101 (98)
Space heating per m2                                                                                 (98) / (4) =     42.4386 (99)
```

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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 %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6386.2141	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1180.0966	927.0288	764.1270	416.1612	162.5132	0.0000	0.0000	0.0000	0.0000	457.9563	855.3165	1207.9105	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1262.1354	991.4747	817.2481	445.0922	173.8109	0.0000	0.0000	0.0000	0.0000	489.7928	914.7770	1291.8829	(211)
Water heating 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	(215)
Water heating													
Water heating requirement													
	218.0987	192.1598	201.6378	180.5160	176.7267	157.6633	151.1822	166.2198	166.0284	187.1964	198.2415	212.7707	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.6459	88.4634	88.0354	86.9719	84.5912	79.8000	79.8000	79.8000	79.8000	87.1109	88.2729	88.7184	(217)
Fuel for water heating, kWh/month													
	246.0335	217.2195	229.0417	207.5566	208.9186	197.5730	189.4514	208.2955	208.0557	214.8944	224.5780	239.8270	(219)
Water heating fuel used												2591.4450	(219)
Annual totals kWh/year													
Space heating fuel - main system												6386.2141	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												497.4787	(232)
Total delivered energy for all uses												9550.1377	(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	6386.2141	0.2160	1379.4222	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2591.4450	0.2160	559.7521	(264)
Space and water heating			1939.1744	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	497.4787	0.5190	258.1914	(268)
Total CO2, kg/m2/year			2236.2908	(272)
Emissions per m2 for space and water heating			13.7823	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.8350	(272b)
Emissions per m2 for pumps and fans			0.2767	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7823 * 1.00) + 1.8350 + 0.2767, rounded to 2 d.p.			15.8900	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.3700	(1b)	x 2.3000	(2b) =	166.4510	(1b) - (3b)
First floor	68.3300	(1c)	x 2.5600	(2c) =	174.9248	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		341.3758	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3677	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2849	(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	0.3633	0.3562	0.3491	0.3134	0.3063	0.2707	0.2707	0.2636	0.2849	0.3063	0.3206	0.3348	(22b)
Effective ac	0.5660	0.5634	0.5609	0.5491	0.5469	0.5366	0.5366	0.5347	0.5406	0.5469	0.5514	0.5560	(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	
Opening Type 1 (Uw = 1.41)			25.7700	1.3347	34.3958			(27)
Opening Type 2			4.3800	1.5000	6.5700			(26a)
150mm TE Platinum GF			72.9600	0.1400	10.2144			(28a)
50mm TE Plat Stone	169.9300	30.1500	139.7800	0.2800	39.1384			(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1100	7.5163			(30)
Grd Floor Bays	4.0400		4.0400	0.1700	0.6868			(30)
Total net area of external elements Aum(A, m2)			315.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.5217			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	135.5000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.7883	(36)
Total fabric heat loss (33) + (36) =	109.3100	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.7617	63.4730	63.1900	61.8609	61.6122	60.4545	60.4545	60.2402	60.9005	61.6122	62.1153	62.6412	(38)
Heat transfer coeff	173.0717	172.7830	172.5000	171.1709	170.9222	169.7645	169.7645	169.5502	170.2105	170.9222	171.4253	171.9512	(39)
Average = Sum(39)m / 12 =												171.1697	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2301	1.2280	1.2260	1.2166	1.2148	1.2066	1.2066	1.2050	1.2097	1.2148	1.2184	1.2221	(40)
HLP (average)												1.2166	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9184 (42)
Average daily hot water use (litres/day)	103.5121 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8633	109.7228	105.5824	101.4419	97.3014	93.1609	93.1609	97.3014	101.4419	105.5824	109.7228	113.8633	(44)
Energy conte	168.8560	147.6826	152.3952	132.8618	127.4841	110.0091	101.9396	116.9771	118.3742	137.9537	150.5873	163.5280	(45)
Energy content (annual)										Total = Sum(45)m =		1628.6487	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(59)

Heat gains from water heating, kWh/month

	35.8819	31.3825	32.3840	28.2331	27.0904	23.3769	21.6622	24.8576	25.1545	29.3152	31.9998	34.7497 (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	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	(66)

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

	28.1693	25.0197	20.3474	15.4043	11.5149	9.7214	10.5043	13.6538	18.3262	23.2693	27.1587	28.9522 (67)

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

	310.2065	313.4255	305.3138	288.0449	266.2461	245.7582	232.0711	228.8521	236.9638	254.2327	276.0315	296.5194 (68)

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

	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920 (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)

	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362 (71)

Water heating gains (Table 5)

	48.2284	46.7002	43.5268	39.2127	36.4118	32.4680	29.1158	33.4108	34.9368	39.4021	44.4442	46.7066 (72)

Total internal gains

	453.3803	451.9215	435.9641	409.4380	380.9488	354.7236	338.4673	342.6929	357.0029	383.6802	414.4105	438.9543 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2100	10.6334	0.7100	0.7000	0.7700	11.7562	(74)
East	12.4300	19.6403	0.7100	0.7000	0.7700	84.0830	(76)
South	2.5500	46.7521	0.7100	0.7000	0.7700	41.0611	(78)
West	7.5800	19.6403	0.7100	0.7000	0.7700	51.2751	(80)

Solar gains	188.1753	354.5032	559.9076	794.1188	962.9129	983.3970	937.0350	810.1214	642.5510	413.4709	231.9497	156.5930 (83)
Total gains	641.5556	806.4247	995.8717	1203.5568	1343.8617	1338.1206	1275.5022	1152.8143	999.5539	797.1510	646.3602	595.5472 (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	30.5988	30.6500	30.7002	30.9386	30.9836	31.1949	31.1949	31.2344	31.1132	30.9836	30.8927	30.7982	
alpha	3.0399	3.0433	3.0467	3.0626	3.0656	3.0797	3.0797	3.0823	3.0742	3.0656	3.0595	3.0532	
util living area	0.9920	0.9835	0.9627	0.9107	0.8133	0.6715	0.5330	0.5942	0.8116	0.9509	0.9865	0.9936	(86)
MIT	18.6944	18.9645	19.4203	19.9988	20.4898	20.8065	20.9309	20.9022	20.6264	19.9526	19.2089	18.6450	(87)
Th 2	19.8960	19.8976	19.8992	19.9068	19.9082	19.9147	19.9147	19.9160	19.9122	19.9082	19.9053	19.9024	(88)
util rest of house	0.9903	0.9801	0.9547	0.8908	0.7700	0.5927	0.4206	0.4820	0.7506	0.9362	0.9831	0.9923	(89)
MIT 2	17.7848	18.0543	18.5059	19.0730	19.5299	19.8023	19.8877	19.8743	19.6664	19.0404	18.3046	17.7401	(90)
Living area fraction										fLA = Living area / (4) =		0.1472	(91)
MIT	17.9187	18.1883	18.6405	19.2093	19.6712	19.9501	20.0413	20.0256	19.8077	19.1747	18.4377	17.8733	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9187	18.1883	18.6405	19.2093	19.6712	19.9501	20.0413	20.0256	19.8077	19.1747	18.4377	17.8733	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9860	0.9727	0.9427	0.8751	0.7592	0.5955	0.4346	0.4944	0.7437	0.9230	0.9767	0.9887	(94)
Useful gains	632.5693	784.4406	938.8043	1053.2642	1020.2455	796.8705	554.3853	569.9764	743.3796	735.7785	631.3268	588.8034	(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	2357.0036	2295.9873	2094.2306	1764.6507	1362.4594	908.2639	584.2071	614.7225	971.5031	1465.5999	1943.5716	2351.1327	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1282.9792	1015.7594	859.6371	512.1982	254.6071	0.0000	0.0000	0.0000	0.0000	542.9871	944.8162	1311.1730	(98)
Space heating												6724.1575	(98)
Space heating per m2											(98) / (4) =	47.7907	(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	1595.7868	1256.2577	1288.5813	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7754	0.8394	0.8022	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1237.3694	1054.4766	1033.7591	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1686.7967	1610.7839	1469.8079	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

```
                0.0000     0.0000     0.0000     0.0000     0.0000   323.5876   413.8926   324.4203     0.0000     0.0000     0.0000     0.0000 (104)
Space cooling                                                                                                                      1061.9006 (104)
Cooled fraction                                                                                    fC = cooled area / (4) =           1.0000 (105)
Intermittency factor (Table 10b)
                0.0000     0.0000     0.0000     0.0000     0.0000     0.2500     0.2500     0.2500     0.0000     0.0000     0.0000     0.0000 (106)
Space cooling kWh
                0.0000     0.0000     0.0000     0.0000     0.0000    80.8969   103.4732    81.1051     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                                       265.4751 (107)
Space cooling per m2                                                                                                                  1.8868 (108)
Energy for space heating                                                                                                             47.7907 (99)
Energy for space cooling                                                                                                              1.8868 (108)
Total                                                                                                                                49.6776 (109)
Dwelling Fabric Energy Efficiency (DFEE)                                                                                              49.7 (109)


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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	72.3700 (1b)	x	2.3000 (2b)	=	166.4510	(1b) - (3b)
First floor	68.3300 (1c)	x	2.5600 (2c)	=	174.9248	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	341.3758	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1172	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3672	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2846	(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	0.3628	0.3557	0.3486	0.3130	0.3059	0.2703	0.2703	0.2632	0.2846	0.3059	0.3201	0.3344	(22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5512	0.5559	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			4.3800	1.2000	5.2560			(26a)
TER Opening Type (Uw = 1.40)			25.7700	1.3258	34.1648			(27)
150mm TE Platinum GF			72.9600	0.1300	9.4848			(28a)
50mm TE Plat Stone	169.9300	30.1500	139.7800	0.1800	25.1604			(29a)
1st Flr Horiz Cl	68.3300		68.3300	0.1300	8.8829			(30)
Grd Floor Bays	4.0400		4.0400	0.1300	0.5252			(30)
Total net area of external elements Aum(A, m2)			315.2600					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	83.4741			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.3361	(36)
Total fabric heat loss					(33) + (36) =		98.8102	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	63.7415	63.4536	63.1714	61.8458	61.5978	60.4433	60.4433	60.2295	60.8880	61.5978	62.0995	62.6241	(38)
Heat transfer coeff	162.5517	162.2638	161.9816	160.6560	160.4080	159.2535	159.2535	159.0397	159.6982	160.4080	160.9097	161.4342	(39)
Average = Sum(39)m / 12 =												160.6548	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1553	1.1533	1.1513	1.1418	1.1401	1.1319	1.1319	1.1303	1.1350	1.1401	1.1436	1.1474	(40)
HLP (average)												1.1418	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9184	(42)
Average daily hot water use (litres/day)	103.5121	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8633	109.7228	105.5824	101.4419	97.3014	93.1609	93.1609	97.3014	101.4419	105.5824	109.7228	113.8633	(44)
Energy conte	168.8560	147.6826	152.3952	132.8618	127.4841	110.0091	101.9396	116.9771	118.3742	137.9537	150.5873	163.5280	(45)
Energy content (annual)										Total = Sum(45)m =		1628.6487	(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)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(59)

Heat gains from water heating, kWh/month

	35.8819	31.3825	32.3840	28.2331	27.0904	23.3769	21.6622	24.8576	25.1545	29.3152	31.9998	34.7497 (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	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	145.9202	(66)

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

	28.1693	25.0197	20.3474	15.4043	11.5149	9.7214	10.5043	13.6538	18.3262	23.2693	27.1587	28.9522 (67)

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

	310.2065	313.4255	305.3138	288.0449	266.2461	245.7582	232.0711	228.8521	236.9638	254.2327	276.0315	296.5194 (68)

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

	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920	37.5920 (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)

	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362	-116.7362 (71)

Water heating gains (Table 5)

	48.2284	46.7002	43.5268	39.2127	36.4118	32.4680	29.1158	33.4108	34.9368	39.4021	44.4442	46.7066 (72)

Total internal gains

	453.3803	451.9215	435.9641	409.4380	380.9488	354.7236	338.4673	342.6929	357.0029	383.6802	414.4105	438.9543 (73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.2100	10.6334	0.6300	0.7000	0.7700	10.4315	(74)
East	12.4300	19.6403	0.6300	0.7000	0.7700	74.6088	(76)
South	2.5500	46.7521	0.6300	0.7000	0.7700	36.4345	(78)
West	7.5800	19.6403	0.6300	0.7000	0.7700	45.4976	(80)

Solar gains	166.9725	314.5592	496.8194	704.6406	854.4156	872.5917	831.4536	718.8401	570.1509	366.8826	205.8145	138.9487 (83)
Total gains	620.3527	766.4807	932.7835	1114.0786	1235.3645	1227.3153	1169.9208	1061.5330	927.1538	750.5628	620.2250	577.9030 (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	60.1091	60.2157	60.3207	60.8184	60.9124	61.3540	61.3540	61.4364	61.1831	60.9124	60.7225	60.5252	
alpha	5.0073	5.0144	5.0214	5.0546	5.0608	5.0903	5.0903	5.0958	5.0789	5.0608	5.0482	5.0350	
util living area	0.9995	0.9985	0.9941	0.9735	0.9029	0.7497	0.5804	0.6533	0.8985	0.9903	0.9989	0.9997	(86)
MIT	19.6033	19.7678	20.0514	20.4255	20.7483	20.9336	20.9855	20.9745	20.8200	20.3815	19.9193	19.5746	(87)
Th 2	19.9559	19.9576	19.9592	19.9668	19.9682	19.9749	19.9749	19.9761	19.9723	19.9682	19.9654	19.9623	(88)
util rest of house	0.9994	0.9979	0.9919	0.9626	0.8632	0.6595	0.4546	0.5252	0.8402	0.9849	0.9984	0.9996	(89)
MIT 2	18.6723	18.8379	19.1217	19.4952	19.7944	19.9437	19.9711	19.9686	19.8661	19.4577	18.9958	18.6488	(90)
Living area fraction									fLA = Living area / (4) =			0.1472	(91)
MIT	18.8093	18.9748	19.2586	19.6321	19.9348	20.0894	20.1205	20.1167	20.0065	19.5936	19.1317	18.7851	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8093	18.9748	19.2586	19.6321	19.9348	20.0894	20.1205	20.1167	20.0065	19.5936	19.1317	18.7851	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9972	0.9898	0.9581	0.8617	0.6706	0.4732	0.5440	0.8426	0.9821	0.9978	0.9994	(94)
Useful gains	619.7825	764.3432	923.2801	1067.4055	1064.4529	822.9972	553.6608	577.4542	781.2222	737.1162	618.8771	577.5331	(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	2358.5129	2283.8295	2066.6551	1724.1815	1320.9296	874.2105	560.6450	591.0975	943.2535	1442.6515	1936.0169	2354.5301	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)

Space heating kWh

	1293.6154	1021.0948	850.6710	472.8787	190.8186	0.0000	0.0000	0.0000	0.0000	524.9183	948.3406	1322.0858 (98)

Space heating 6624.4232 (98)

Space heating per m2 (98) / (4) = 47.0819 (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	1496.9828	1178.4759	1208.7017	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8519	0.9162	0.8818	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1275.2086	1079.7188	1065.8640	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1557.2840	1487.3770	1363.1154	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	203.0943	303.2977	221.1551	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												727.5471 (104)
Cooled fraction											fC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	50.7736	75.8244	55.2888	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												181.8868 (107)
Space cooling per m2												1.2927 (108)
Energy for space heating												47.0819 (99)
Energy for space cooling												1.2927 (108)
Total												48.3746 (109)
Target Fabric Energy Efficiency (TFEE)												55.6 (109)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

ENVIRONMENTAL ECONOMICS

Property Reference	Plot 101 P331 SD	**Issued on Date**	19/03/2024
Assessment Reference	1	**Prop Type Ref**	
Property	Plot 101, White Post Road, Bodicote, OX15		

SAP Rating	85 B	**DER**	15.90	**TER**	17.50
Environmental	87 B	**% DER<TER**	9.13		
CO_2 Emissions (t/year)	1.31	**DFEE**	45.80	**TFEE**	50.95
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.10		

Assessor Details	Mr. Thomas Ferrett, Thomas Ferrett, Tel: 01582 544250, tom.ferrett@ee-ltd.co.uk	**Assessor ID**	Q141-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Semi-Detached House, total floor area 92 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.50 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.90 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.8 kWh/m²/yrOK
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2 Fabric U-values

Element	Average	Highest	
External wall	0.28 (max. 0.30)	0.28 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.41 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction
---
3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK
---
4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None
---
5 Cylinder insulation
Hot water storage No cylinder
---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK
---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK
---
8 Mechanical ventilation
Not applicable
---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.35 m², No overhang
Windows facing South East: 4.53 m², No overhang
Windows facing South: 4.67 m², No overhang
Windows facing North West: 3.44 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours
---
10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.037 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.8800 (1b)	x	2.3100 (2b)	=	105.9828	(1b) - (3b)
First floor	45.8800 (1c)	x	2.5900 (2c)	=	118.8292	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	224.8120	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1779	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4284	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3642	(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	0.4643	0.4552	0.4461	0.4006	0.3915	0.3460	0.3460	0.3369	0.3642	0.3915	0.4097	0.4279	(22b)
Effective ac	0.6078	0.6036	0.5995	0.5802	0.5766	0.5598	0.5598	0.5567	0.5663	0.5766	0.5839	0.5915	(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	
Opening Type 1 (Uw = 1.41)			15.9900	1.3347	21.3422			(27)
Opening Type 12			2.3800	1.1000	2.6180			(26a)
150mm TE Platinum			45.8800	0.1400	6.4232			(28a)
50mm TE Plat Stone	109.7100	18.3700	91.3400	0.2800	25.5752			(29a)
400mm mineral wool	45.8800		45.8800	0.1100	5.0468			(30)
Total net area of external elements Aum(A, m2)			201.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.0054			(33)
E-WM-20/22			26.4100	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	154.2600	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.4418	(36)
Total fabric heat loss (33) + (36) =	68.4472	(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	45.0907	44.7802	44.4758	43.0462	42.7787	41.5336	41.5336	41.3030	42.0132	42.7787	43.3198	43.8855	(38)
Heat transfer coeff	113.5380	113.2274	112.9231	111.4934	111.2260	109.9808	109.9808	109.7502	110.4604	111.2260	111.7671	112.3328	(39)
Average = Sum(39)m / 12 =												111.4922	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2373	1.2340	1.2306	1.2151	1.2121	1.1986	1.1986	1.1961	1.2038	1.2121	1.2180	1.2242	(40)
HLP (average)												1.2150	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6491 (42)
Average daily hot water use (litres/day)	97.1150 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.8265	102.9419	99.0573	95.1727	91.2881	87.4035	87.4035	91.2881	95.1727	99.0573	102.9419	106.8265	(44)
Energy conte	158.4206	138.5557	142.9770	124.6508	119.6055	103.2104	95.6396	109.7479	111.0586	129.4281	141.2809	153.4219	(45)
Energy content (annual)										Total = Sum(45)m =		1527.9969	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7631	20.7833	21.4466	18.6976	17.9408	15.4816	14.3459	16.4622	16.6588	19.4142	21.1921	23.0133	(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)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Combi loss	14.1368	12.7578	14.0965	13.5975	14.0186	13.5293	13.9572	13.9970	13.5665	14.0643	13.6519	14.1248	(61)
Total heat required for water heating calculated for each month													
	172.5574	151.3135	157.0735	138.2484	133.6241	116.7397	109.5968	123.7449	124.6251	143.4923	154.9328	167.5467	(62)
WWHRS	-28.4295	-25.0142	-25.5303	-21.0063	-19.5052	-16.0911	-13.6189	-16.4892	-16.9700	-20.9777	-24.2991	-27.4782	eq.(G10)
Total of WWHRS savings												-255.4097	
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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h													
	144.1279	126.2993	131.5432	117.2420	114.1189	100.6486	95.9779	107.2557	107.6551	122.5146	130.6336	140.0684	(64)
Total per year (kWh/year) = Sum(64)m =												1438.0853	(64)
Heat gains from water heating, kWh/month													
	56.2090	49.2592	51.0640	44.8458	43.2735	37.6998	35.2895	39.9904	40.3186	46.5509	50.3889	54.5440	(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	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1797	19.6998	16.0210	12.1289	9.0665	7.6543	8.2708	10.7506	14.4295	18.3216	21.3840	22.7961	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	242.2787	244.7927	238.4573	224.9699	207.9445	191.9430	181.2530	178.7389	185.0744	198.5618	215.5872	231.5887	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	(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)													
	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	(71)
Water heating gains (Table 5)													
	75.5498	73.3024	68.6344	62.2858	58.1633	52.3608	47.4321	53.7506	55.9981	62.5684	69.9845	73.3118	(72)
Total internal gains													
	405.7439	403.5307	388.8484	365.1204	340.9100	317.6939	302.6917	308.9759	321.2377	345.1875	372.6915	393.4324	(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	3.3500	10.6334	0.7100	0.7000	0.7700	12.2689	(74)
Southeast	4.5300	36.7938	0.7100	0.7000	0.7700	57.4067	(77)
South	4.6700	46.7521	0.7100	0.7000	0.7700	75.1982	(78)
Northwest	3.4400	11.2829	0.7100	0.7000	0.7700	13.3681	(81)

Solar gains	158.2420	271.5979	379.5388	487.5930	564.8829	569.8211	545.5558	485.9981	416.3888	302.0719	189.8514	135.2514	(83)
Total gains	563.9859	675.1286	768.3872	852.7134	905.7930	887.5150	848.2475	794.9740	737.6265	647.2594	562.5428	528.6838	(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	34.6308	34.7258	34.8194	35.2659	35.3507	35.7509	35.7509	35.8261	35.5957	35.3507	35.1796	35.0024	
alpha	3.3087	3.3151	3.3213	3.3511	3.3567	3.3834	3.3834	3.3884	3.3730	3.3567	3.3453	3.3335	
util living area													
	0.9872	0.9763	0.9553	0.9085	0.8187	0.6757	0.5304	0.5774	0.7838	0.9318	0.9784	0.9896	(86)
MIT	19.0779	19.3283	19.7013	20.1709	20.5771	20.8490	20.9507	20.9336	20.7336	20.2003	19.5532	19.0359	(87)
Th 2	19.8902	19.8929	19.8956	19.9080	19.9103	19.9211	19.9211	19.9232	19.9170	19.9103	19.9056	19.9007	(88)
util rest of house													
	0.9844	0.9711	0.9452	0.8867	0.7736	0.5940	0.4161	0.4637	0.7155	0.9111	0.9728	0.9873	(89)
MIT 2	17.3366	17.7008	18.2397	18.9118	19.4608	19.7979	19.8950	19.8848	19.6736	18.9671	18.0383	17.2818	(90)
Living area fraction									fLA = Living area / (4) =			0.1794	(91)
MIT	17.6489	17.9927	18.5019	19.1377	19.6610	19.9864	20.0843	20.0730	19.8638	19.1883	18.3100	17.5965	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.4989	17.8427	18.3519	18.9877	19.5110	19.8364	19.9343	19.9230	19.7138	19.0383	18.1600	17.4465	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9750	0.9572	0.9258	0.8634	0.7541	0.5868	0.4176	0.4637	0.7004	0.8888	0.9595	0.9793	(94)
Useful gains	549.9110	646.2214	711.3906	736.2507	683.0992	520.8249	354.2010	368.6144	516.6510	575.2943	539.7859	517.7347	(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													
	1498.5779	1465.4745	1338.3545	1124.7069	868.7875	575.9037	366.7138	386.6459	620.1002	938.5599	1236.1456	1488.0106	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	705.8082	550.5381	466.4612	279.6885	138.1521	0.0000	0.0000	0.0000	0.0000	270.2696	501.3790	721.8853	(98)
Space heating												3634.1819	(98)
Space heating per m2											(98) / (4) =	39.6053	(99)

8c. Space cooling requirement

Not applicable

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 %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4015.6706	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	705.8082	550.5381	466.4612	279.6885	138.1521	0.0000	0.0000	0.0000	0.0000	270.2696	501.3790	721.8853	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	779.8985	608.3294	515.4267	309.0480	152.6542	0.0000	0.0000	0.0000	0.0000	298.6405	554.0099	797.6633	(211)
Water heating 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	(215)
Water heating													
Water heating requirement													
	144.1279	126.2993	131.5432	117.2420	114.1189	100.6486	95.9779	107.2557	107.6551	122.5146	130.6336	140.0684	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.9409	89.8852	89.7761	89.5307	89.0238	87.3000	87.3000	87.3000	87.3000	89.4770	89.8195	89.9641	(217)
Fuel for water heating, kWh/month													
	160.2472	140.5118	146.5236	130.9518	128.1891	115.2905	109.9403	122.8588	123.3163	136.9231	145.4402	155.6936	(219)
Water heating fuel used												1615.8863	(219)
Annual totals kWh/year													
Space heating fuel - main system												4015.6706	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												391.7004	(232)
Total delivered energy for all uses												6098.2573	(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	4015.6706	0.2160	867.3848	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1615.8863	0.2160	349.0314	(264)
Space and water heating			1216.4163	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	391.7004	0.5190	203.2925	(268)
Total CO2, kg/year			1458.6338	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.9000	ZC1
Total Floor Area	TFA	91.7600	
Assumed number of occupants	N	2.6491	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6462	ZC2
CO2 emissions from cooking, equation (L16)		1.9897	ZC3
Total CO2 emissions		33.5359	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.5359	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.8800 (1b)	x	2.3100 (2b)	=	105.9828	(1b) - (3b)
First floor	45.8800 (1c)	x	2.5900 (2c)	=	118.8292	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	224.8120	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1334	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3834	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3259	(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	0.4156	0.4074	0.3993	0.3585	0.3504	0.3096	0.3096	0.3015	0.3259	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5863	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5454	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.3800	1.2000	2.8560			(26a)
TER Opening Type (Uw = 1.40)			15.9900	1.3258	21.1989			(27)
150mm TE Platinum			45.8800	0.1300	5.9644			(28a)
50mm TE Plat Stone	109.7100	18.3700	91.3400	0.1800	16.4412			(29a)
400mm mineral wool	45.8800		45.8800	0.1300	5.9644			(30)
Total net area of external elements Aum(A, m2)			201.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4249			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.3605	(36)
Total fabric heat loss (33) + (36) =	62.7854	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4997	43.2510	43.0071	41.8619	41.6477	40.6502	40.6502	40.4655	41.0344	41.6477	42.0811	42.5343	(38)
Heat transfer coeff	106.2851	106.0363	105.7925	104.6473	104.4330	103.4356	103.4356	103.2509	103.8198	104.4330	104.8665	105.3196	(39)
Average = Sum(39)m / 12 =												104.6463	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1583	1.1556	1.1529	1.1404	1.1381	1.1272	1.1272	1.1252	1.1314	1.1381	1.1428	1.1478	(40)
HLP (average)												1.1404	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6491 (42)
Average daily hot water use (litres/day)	97.1150 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.8265	102.9419	99.0573	95.1727	91.2881	87.4035	87.4035	91.2881	95.1727	99.0573	102.9419	106.8265	(44)
Energy conte	158.4206	138.5557	142.9770	124.6508	119.6055	103.2104	95.6396	109.7479	111.0586	129.4281	141.2809	153.4219	(45)
Energy content (annual)										Total = Sum(45)m =		1527.9969	(45)
Distribution loss (46)m = 0.15 x (45)m	23.7631	20.7833	21.4466	18.6976	17.9408	15.4816	14.3459	16.4622	16.6588	19.4142	21.1921	23.0133	(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													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	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)
Combi loss	50.9589	46.0274	50.4785	46.9345	46.5194	43.1031	44.5399	46.5194	46.9345	50.4785	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month													
	209.3795	184.5831	193.4555	171.5853	166.1249	146.3135	140.1795	156.2673	157.9931	179.9066	190.5959	204.3808	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	209.3795	184.5831	193.4555	171.5853	166.1249	146.3135	140.1795	156.2673	157.9931	179.9066	190.5959	204.3808	(64)
								Total per year (kWh/year) = Sum(64)m =				2100.7649	(64)
Heat gains from water heating, kWh/month													
	65.4146	57.5766	60.1595	53.1800	51.3987	45.0932	42.9351	48.1210	48.6606	55.6545	59.3047	63.7525	(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	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1797	19.6998	16.0210	12.1289	9.0665	7.6543	8.2708	10.7506	14.4295	18.3216	21.3840	22.7961	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	242.2787	244.7927	238.4573	224.9699	207.9445	191.9430	181.2530	178.7389	185.0744	198.5618	215.5872	231.5887	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	(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)													
	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	(71)
Water heating gains (Table 5)													
	87.9228	85.6795	80.8595	73.8611	69.0842	62.6295	57.7085	64.6788	67.5842	74.8044	82.3676	85.6888	(72)
Total internal gains													
	418.1169	415.9078	401.0736	376.6957	351.8310	327.9626	312.9681	319.9042	332.8238	357.4235	385.0745	405.8094	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3500	10.6334	0.6300	0.7000	0.7700	10.8865	(74)
Southeast	4.5300	36.7938	0.6300	0.7000	0.7700	50.9384	(77)
South	4.6700	46.7521	0.6300	0.7000	0.7700	66.7251	(78)
Northwest	3.4400	11.2829	0.6300	0.7000	0.7700	11.8619	(81)

Solar gains	140.4119	240.9953	336.7739	432.6529	501.2342	505.6159	484.0847	431.2377	369.4717	268.0356	168.4597	120.0118	(83)
Total gains	558.5288	656.9031	737.8475	809.3487	853.0652	833.5785	797.0528	751.1419	702.2956	625.4591	553.5342	525.8213	(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	59.9541	60.0947	60.2332	60.8924	61.0173	61.6057	61.6057	61.7159	61.3777	61.0173	60.7651	60.5036	
alpha	4.9969	5.0063	5.0155	5.0595	5.0678	5.1070	5.1070	5.1144	5.0918	5.0678	5.0510	5.0336	
util living area													
	0.9979	0.9948	0.9866	0.9599	0.8843	0.7274	0.5565	0.6086	0.8440	0.9732	0.9953	0.9984	(86)
MIT	19.7557	19.9227	20.1755	20.4982	20.7776	20.9429	20.9881	20.9817	20.8731	20.5103	20.0708	19.7259	(87)
Th 2	19.9535	19.9557	19.9578	19.9679	19.9698	19.9786	19.9786	19.9803	19.9752	19.9698	19.9660	19.9620	(88)
util rest of house													
	0.9972	0.9931	0.9818	0.9446	0.8403	0.6367	0.4348	0.4854	0.7719	0.9600	0.9934	0.9979	(89)
MIT 2	18.2969	18.5419	18.9101	19.3766	19.7493	19.9401	19.9742	19.9727	19.8731	19.4018	18.7662	18.2594	(90)
Living area fraction									fLA = Living area / (4) =			0.1794	(91)
MIT	18.5585	18.7896	19.1371	19.5778	19.9337	20.1199	20.1561	20.1537	20.0525	19.6007	19.0002	18.5224	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5585	18.7896	19.1371	19.5778	19.9337	20.1199	20.1561	20.1537	20.0525	19.6007	19.0002	18.5224	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9902	0.9766	0.9372	0.8385	0.6503	0.4567	0.5074	0.7782	0.9536	0.9908	0.9968	(94)
Useful gains	556.1173	650.4616	720.5899	758.5116	715.2931	542.0492	363.9778	381.0947	546.5053	596.4551	548.4232	524.1166	(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													
	1515.4697	1472.7971	1336.9095	1117.4070	859.8730	570.9585	367.8287	387.5683	617.9874	939.9685	1247.9348	1508.4351	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	713.7582	552.6094	458.5418	258.4047	107.5675	0.0000	0.0000	0.0000	0.0000	255.5740	503.6484	732.3330	(98)
Space heating												3582.4370	(98)
Space heating per m2											(98) / (4) =	39.0414	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3835.5857	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	713.7582	552.6094	458.5418	258.4047	107.5675	0.0000	0.0000	0.0000	0.0000	255.5740	503.6484	732.3330	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	764.1951	591.6589	490.9441	276.6645	115.1686	0.0000	0.0000	0.0000	0.0000	273.6339	539.2381	784.0824	(211)
Water heating 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	(215)
Water heating													
Water heating requirement													
	209.3795	184.5831	193.4555	171.5853	166.1249	146.3135	140.1795	156.2673	157.9931	179.9066	190.5959	204.3808	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.8926	87.6399	87.1477	86.0796	83.9880	80.3000	80.3000	80.3000	80.3000	85.9347	87.3826	87.9854	(217)
Fuel for water heating, kWh/month													
	238.2220	210.6152	221.9859	199.3334	197.7960	182.2086	174.5697	194.6043	196.7535	209.3527	218.1166	232.2895	(219)
Water heating fuel used												2475.8475	(219)
Annual totals kWh/year													
Space heating fuel - main system												3835.5857	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												391.7004	(232)
Total delivered energy for all uses												6778.1336	(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	3835.5857	0.2160	828.4865	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2475.8475	0.2160	534.7831	(264)
Space and water heating			1363.2696	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	391.7004	0.5190	203.2925	(268)
Total CO2, kg/m2/year			1605.4871	(272)
Emissions per m2 for space and water heating			14.8569	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2155	(272b)
Emissions per m2 for pumps and fans			0.4242	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8569 * 1.00) + 2.2155 + 0.4242, rounded to 2 d.p.			17.5000	(273)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.8800 (1b)	x	2.3100 (2b)	=	105.9828	(1b) - (3b)
First floor	45.8800 (1c)	x	2.5900 (2c)	=	118.8292	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	224.8120	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1334	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.3839	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3264	(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	0.4161	0.4079	0.3998	0.3590	0.3508	0.3100	0.3100	0.3019	0.3264	0.3508	0.3671	0.3835	(22b)
Effective ac	0.5866	0.5832	0.5799	0.5644	0.5615	0.5481	0.5481	0.5456	0.5533	0.5615	0.5674	0.5735	(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	
Opening Type 1 (Uw = 1.41)			15.9900	1.3347	21.3422			(27)
Opening Type 12			2.3800	1.1000	2.6180			(26a)
150mm TE Platinum			45.8800	0.1400	6.4232			(28a)
50mm TE Plat Stone	109.7100	18.3700	91.3400	0.2800	25.5752			(29a)
400mm mineral wool	45.8800		45.8800	0.1100	5.0468			(30)
Total net area of external elements Aum(A, m2)			201.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		61.0054			(33)
E-WM-20/22			26.4100	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							154.2600	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.4418	(36)
Total fabric heat loss					(33) + (36) =		68.4472	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.5164	43.2670	43.0226	41.8744	41.6596	40.6595	40.6595	40.4743	41.0447	41.6596	42.0941	42.5485	(38)
Heat transfer coeff	111.9636	111.7142	111.4698	110.3216	110.1068	109.1068	109.1068	108.9216	109.4920	110.1068	110.5414	110.9957	(39)
Average = Sum(39)m / 12 =												110.3206	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2202	1.2175	1.2148	1.2023	1.1999	1.1890	1.1890	1.1870	1.1932	1.1999	1.2047	1.2096	(40)
HLP (average)												1.2023	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6491	(42)
Average daily hot water use (litres/day)	97.1150	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.8265	102.9419	99.0573	95.1727	91.2881	87.4035	87.4035	91.2881	95.1727	99.0573	102.9419	106.8265	(44)
Energy conte	158.4206	138.5557	142.9770	124.6508	119.6055	103.2104	95.6396	109.7479	111.0586	129.4281	141.2809	153.4219	(45)
Energy content (annual)										Total = Sum(45)m =		1527.9969	(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)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(59)

Heat gains from water heating, kWh/month

	33.6644	29.4431	30.3826	26.4883	25.4162	21.9322	20.3234	23.3214	23.6000	27.5035	30.0222	32.6022 (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	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	(66)

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

	22.1797	19.6998	16.0210	12.1289	9.0665	7.6543	8.2708	10.7506	14.4295	18.3216	21.3840	22.7961 (67)

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

	242.2787	244.7927	238.4573	224.9699	207.9445	191.9430	181.2530	178.7389	185.0744	198.5618	215.5872	231.5887 (68)

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

	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)

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

	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621 (71)

Water heating gains (Table 5)

	45.2478	43.8141	40.8369	36.7893	34.1615	30.4614	27.3164	31.3460	32.7777	36.9670	41.6975	43.8201 (72)

Total internal gains

	372.4420	371.0424	358.0509	336.6239	313.9083	292.7945	279.5760	283.5714	295.0174	316.5861	341.4044	360.9407 (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	3.3500	10.6334	0.7100	0.7000	0.7700	12.2689	(74)
Southeast	4.5300	36.7938	0.7100	0.7000	0.7700	57.4067	(77)
South	4.6700	46.7521	0.7100	0.7000	0.7700	75.1982	(78)
Northwest	3.4400	11.2829	0.7100	0.7000	0.7700	13.3681	(81)

Solar gains	158.2420	271.5979	379.5388	487.5930	564.8829	569.8211	545.5558	485.9981	416.3888	302.0719	189.8514	135.2514 (83)
Total gains	530.6839	642.6403	737.5897	824.2169	878.7912	862.6156	825.1318	769.5694	711.4061	618.6580	531.2558	496.1921 (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	35.1178	35.1962	35.2734	35.6405	35.7100	36.0373	36.0373	36.0986	35.9105	35.7100	35.5696	35.4240	
alpha	3.3412	3.3464	3.3516	3.3760	3.3807	3.4025	3.4025	3.4066	3.3940	3.3807	3.3713	3.3616	
util living area	0.9893	0.9792	0.9595	0.9145	0.8268	0.6854	0.5394	0.5890	0.7951	0.9385	0.9816	0.9914	(86)
MIT	19.0615	19.3133	19.6884	20.1585	20.5691	20.8445	20.9491	20.9306	20.7244	20.1821	19.5310	19.0158	(87)
Th 2	19.9039	19.9061	19.9082	19.9182	19.9200	19.9288	19.9288	19.9304	19.9254	19.9200	19.9163	19.9123	(88)
util rest of house	0.9869	0.9747	0.9502	0.8939	0.7830	0.6043	0.4246	0.4750	0.7286	0.9195	0.9768	0.9895	(89)
MIT 2	18.1405	18.3914	18.7624	19.2248	19.6056	19.8415	19.9102	19.9028	19.7519	19.2573	18.6169	18.1012	(90)
Living area fraction									fLA = Living area / (4) =			0.1794	(91)
MIT	18.3057	18.5568	18.9285	19.3923	19.7784	20.0214	20.0965	20.0872	19.9264	19.4232	18.7809	18.2653	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3057	18.5568	18.9285	19.3923	19.7784	20.0214	20.0965	20.0872	19.9264	19.4232	18.7809	18.2653	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9821	0.9672	0.9396	0.8818	0.7764	0.6120	0.4437	0.4930	0.7286	0.9083	0.9699	0.9854	(94)
Useful gains	521.1956	621.5448	693.0183	726.7574	682.2673	527.9394	366.1193	379.3948	518.3609	561.9362	515.2663	488.9634	(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	1568.1322	1525.6594	1385.4073	1157.5295	889.4882	591.5094	381.4952	401.6102	637.9400	971.4941	1291.2229	1561.1850	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	778.9209	607.5650	515.1374	310.1559	154.1723	0.0000	0.0000	0.0000	0.0000	304.7111	558.6888	797.7329	(98)
Space heating												4027.0843	(98)
Space heating per m2											(98) / (4) =	43.8871	(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	1025.6035	807.3900	827.8039	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8019	0.8656	0.8398	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	822.4826	698.8532	695.1949	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1108.6283	1062.7073	999.5713	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

Space cooling kWh

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	206.0250	270.7074	226.4560	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												703.1884 (104)
Cooled fraction										fC = cooled area / (4) =		1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	51.5062	67.6769	56.6140	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												175.7971 (107)
Space cooling per m2												1.9158 (108)
Energy for space heating												43.8871 (99)
Energy for space cooling												1.9158 (108)
Total												45.8030 (109)
Dwelling Fabric Energy Efficiency (DFEE)												45.8 (109)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	45.8800 (1b)	x	2.3100 (2b)	=	105.9828	(1b) - (3b)
First floor	45.8800 (1c)	x	2.5900 (2c)	=	118.8292	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.7600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	224.8120	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1334	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3834	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3259	(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	0.4156	0.4074	0.3993	0.3585	0.3504	0.3096	0.3096	0.3015	0.3259	0.3504	0.3667	0.3830	(22b)
Effective ac	0.5863	0.5830	0.5797	0.5643	0.5614	0.5479	0.5479	0.5454	0.5531	0.5614	0.5672	0.5733	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Semi-glazed door			2.3800	1.2000	2.8560			(26a)
TER Opening Type (Uw = 1.40)			15.9900	1.3258	21.1989			(27)
150mm TE Platinum			45.8800	0.1300	5.9644			(28a)
50mm TE Plat Stone	109.7100	18.3700	91.3400	0.1800	16.4412			(29a)
400mm mineral wool	45.8800		45.8800	0.1300	5.9644			(30)
Total net area of external elements Aum(A, m2)			201.4700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.4249			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.3605	(36)
Total fabric heat loss (33) + (36) =	62.7854	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	43.4997	43.2510	43.0071	41.8619	41.6477	40.6502	40.6502	40.4655	41.0344	41.6477	42.0811	42.5343	(38)
Heat transfer coeff	106.2851	106.0363	105.7925	104.6473	104.4330	103.4356	103.4356	103.2509	103.8198	104.4330	104.8665	105.3196	(39)
Average = Sum(39)m / 12 =												104.6463	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1583	1.1556	1.1529	1.1404	1.1381	1.1272	1.1272	1.1252	1.1314	1.1381	1.1428	1.1478	(40)
HLP (average)												1.1404	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.6491 (42)
Average daily hot water use (litres/day)	97.1150 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.8265	102.9419	99.0573	95.1727	91.2881	87.4035	87.4035	91.2881	95.1727	99.0573	102.9419	106.8265	(44)
Energy conte	158.4206	138.5557	142.9770	124.6508	119.6055	103.2104	95.6396	109.7479	111.0586	129.4281	141.2809	153.4219	(45)
Energy content (annual)										Total = Sum(45)m =		1527.9969	(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													

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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	(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)
Heat gains from water heating, kWh/month													
	33.6644	29.4431	30.3826	26.4883	25.4162	21.9322	20.3234	23.3214	23.6000	27.5035	30.0222	32.6022	(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	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	132.4526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	22.1797	19.6998	16.0210	12.1289	9.0665	7.6543	8.2708	10.7506	14.4295	18.3216	21.3840	22.7961	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	242.2787	244.7927	238.4573	224.9699	207.9445	191.9430	181.2530	178.7389	185.0744	198.5618	215.5872	231.5887	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	36.2453	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	-105.9621	(71)
Water heating gains (Table 5)													
	45.2478	43.8141	40.8369	36.7893	34.1615	30.4614	27.3164	31.3460	32.7777	36.9670	41.6975	43.8201	(72)
Total internal gains													
	372.4420	371.0424	358.0509	336.6239	313.9083	292.7945	279.5760	283.5714	295.0174	316.5861	341.4044	360.9407	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3500	10.6334	0.6300	0.7000	0.7700	10.8865	(74)
Southeast	4.5300	36.7938	0.6300	0.7000	0.7700	50.9384	(77)
South	4.6700	46.7521	0.6300	0.7000	0.7700	66.7251	(78)
Northwest	3.4400	11.2829	0.6300	0.7000	0.7700	11.8619	(81)

Solar gains	140.4119	240.9953	336.7739	432.6529	501.2342	505.6159	484.0847	431.2377	369.4717	268.0356	168.4597	120.0118	(83)
Total gains	512.8538	612.0377	694.8248	769.2768	815.1424	798.4104	763.6607	714.8091	664.4891	584.6218	509.8641	480.9525	(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	59.9541	60.0947	60.2332	60.8924	61.0173	61.6057	61.6057	61.7159	61.3777	61.0173	60.7651	60.5036	
alpha	4.9969	5.0063	5.0155	5.0595	5.0678	5.1070	5.1070	5.1144	5.0918	5.0678	5.0510	5.0336	
util living area													
	0.9986	0.9962	0.9896	0.9668	0.8990	0.7493	0.5781	0.6344	0.8656	0.9795	0.9968	0.9990	(86)
MIT	19.7094	19.8779	20.1342	20.4643	20.7554	20.9345	20.9860	20.9779	20.8550	20.4733	20.0270	19.6803	(87)
Th 2	19.9535	19.9557	19.9578	19.9679	19.9698	19.9786	19.9786	19.9803	19.9752	19.9698	19.9660	19.9620	(88)
util rest of house													
	0.9981	0.9949	0.9858	0.9538	0.8584	0.6593	0.4530	0.5084	0.7981	0.9690	0.9954	0.9986	(89)
MIT 2	18.7764	18.9460	19.2021	19.5327	19.8017	19.9479	19.9750	19.9739	19.8935	19.5472	19.1034	18.7540	(90)
Living area fraction									fLA = Living area / (4) =			0.1794	(91)
MIT	18.9437	19.1132	19.3693	19.6998	19.9727	20.1248	20.1564	20.1540	20.0659	19.7134	19.2691	18.9202	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9437	19.1132	19.3693	19.6998	19.9727	20.1248	20.1564	20.1540	20.0659	19.7134	19.2691	18.9202	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9934	0.9829	0.9495	0.8585	0.6734	0.4756	0.5311	0.8051	0.9656	0.9941	0.9981	(94)
Useful gains	511.5118	608.0279	682.9614	730.4185	699.7917	537.6354	363.2286	379.6588	534.9986	564.4948	506.8780	480.0352	(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													
	1556.4095	1507.1108	1361.4756	1130.1706	863.9475	571.4654	367.8548	387.6023	619.3834	951.7366	1276.1300	1550.3242	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	777.4039	604.1837	504.8146	287.8215	122.1319	0.0000	0.0000	0.0000	0.0000	288.1078	553.8615	796.2950	(98)
Space heating												3934.6200	(98)
Space heating per m2											(98) / (4) =	42.8795	(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	972.2947	765.4235	784.7068	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8607	0.9233	0.9004	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	836.8614	706.6848	706.5606	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1033.5833	990.8580	935.5657	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	141.6398	211.4248	170.3798	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											523.4444	(104)
Cooled fraction									fC = cooled area / (4) =		1.0000	(105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	35.4099	52.8562	42.5949	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling											130.8611	(107)
Space cooling per m2											1.4261	(108)
Energy for space heating											42.8795	(99)
Energy for space cooling											1.4261	(108)
Total											44.3056	(109)
Target Fabric Energy Efficiency (TFEE)											51.0	(109)