



Energy Statement

Silver Birches

Client: Mr Richard Warman
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Revision History

<i>Version</i>	<i>Date Issued</i>	<i>Issued by</i>	<i>QA Check</i>
1	22/12/2023	Ruth Ferguson	DRAFT
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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*
- *Sustainability Statements*
- *Compliance assessments and advice covering*
 - *Part L (SAP)*
 - *Part F (ventilation)*
 - *Part G (water)*
- *Overheating assessments*
- *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
2. Project Overview	2
2.1. Description of Site	2
2.2. Brief	2
2.3. Building Regulations.....	2
3. Design Response	3
3.1. Assessment Methodology.....	3
3.2. Design Philosophy.....	4
3.3. Fabric Improvements Part L1A 2021	5
3.4. Building Services & Renewable Energy (LZCT).....	6
4. Results (Energy and Carbon)	8
4.1. Energy from Renewables	8
5. Conclusion.....	9
Appendix A – Development Drawings.....	10
Appendix B – Low and Zero Carbon Technologies	13
Photovoltaic (PV) Cells.....	13
Solar Hot Water (SHW).....	14
Air Source Heat Pumps (ASHP)	15
Ground Source Heat Pumps (GSHP)	15
Biomass Heating Systems.....	16
Wind Turbines.....	16
WWHRS	17
FGHRS.....	17
Appendix C – SAP Calculations.....	18

1. Executive Summary

- 1.1.1. Environmental Economics Ltd has been commissioned by Mr Richard Warman to prepare an energy report for the residential site Silver Birches. This document sets out how the development proposal presents a positive sustainable development and complies with Policy DM4 set out by the Three Rivers District Council.
- 1.1.2. The proposed development is designed to achieve low carbon emissions in line with Part L 2021 through the adoption of good fabric performance and employment of low and zero carbon technologies.
- 1.1.3. Water efficiency has been reviewed as part of the design process and a Part G compliant specification will be adopted, resulting in the higher standard (lower water use) of 110 litres/person/day.
- 1.1.4. At later design stages, overheating risk will be assessed in accordance with Approved Document O.
- 1.1.5. The policy requires that a 5% reduction in Carbon emissions beyond Part L 2013 be achieved. However, Part L 2021 automatically represents a 31% uplift over Part L 2013, and as this development is being built to Part L 2021, it exceeds the requirements by a very significant margin.
- 1.1.6. The development achieves an uplift of approximately 65% over Part L 2021 (see Table 2).
- 1.1.7. The following Low and Zero Carbon Technologies (LZCT) are currently proposed:
- Air Source Heat Pumps (ASHPs)
 - Photovoltaic (PV) panels
- 1.1.8. 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.
- 1.1.9. While the development is still at an early stage of the design process, it is considered that the proposal meets or exceeds the required level of sustainability across all given criteria.

2. Project Overview

2.1. Description of Site

- 2.1.1. The site proposal consists of the construction of 1 residential dwelling which consists of a detached house.
- 2.1.2. The proposed site plan is shown in Appendix A.

2.2. Brief

- 2.2.1. The planning authority for this site is the Three Rivers District Council. This report responds to the criteria set out in Policy DM4 as follows:
 - a) From 2013, applicants will be required to demonstrate that development will produce 5% less carbon dioxide emissions than Building Regulations Part L requirements (2013) having regard to feasibility and viability. This may be achieved through a combination of energy efficiency measures, incorporation of on-site low carbon and renewable technologies, connection to a local, decentralized, renewable or low carbon energy supply.*
- 2.2.2. This report seeks to address the condition relevant for the proposed site and demonstrate how the development presents a sustainable strategy.
- 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 single dwelling for this development falls under Part L1A 2021 of the building regulations, and therefore will be required to follow SAP 10 methodology. Part L1A 2021 regulations will have a higher standard in carbon requirements than Part L1A 2013. Specifically, any plots on site which are to be built to the part L 2021 (using SAP 10) will exceed current Part L1A 2013 regulations by 31%.
- 2.3.2. This means that the development automatically meets the 5% uplift over Part L 2013 required, as it is being built to Part L 2021 and therefore represents a minimum 31% uplift.
- 2.3.3. In addition to the higher standards, some of the carbon content for different types of fuel has changed, meaning that the resultant carbon emissions will be calculated differently.

3. Design Response

3.1. Assessment Methodology

3.1.1. Environmental Economics have modelled the proposed dwelling using the software Design SAP 10 by Elmhurst and approved by BRE. The software provides a number of outputs, and based on the specification for this proposed development, we are 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, SAP 10 has been fully approved.

3.1.4. The draft SAP report used in this energy report is 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 2 below.

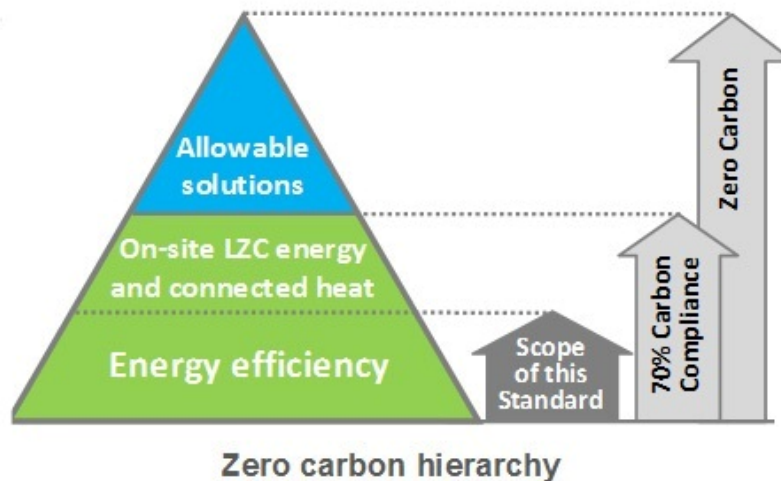


Figure 2

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:

- *Improved insulation levels;*
- *Upgraded heating and hot water controls;*
- *Design air permeability of 4.00m³/hr/m²;*
- *Bespoke, low heat loss thermal bridging details.*

3.3. Fabric Improvements Part L1A 2021

- 3.3.1. The building fabric for the proposed development will be improved in comparison to ADL 2013 specifications, and 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.
- 3.3.2. Proposed fabric designs and U-Values can be found in Table 1 below, along with the backstop U-values for comparison.

Table 1 – Part L 2021 Build Specification

<i>Element</i>	<i>Minimum Standard</i>	<i>Improved Specification</i>	
-	<i>W/m²k</i>	<i>Description</i>	<i>W/m²k</i>
Walls	0.26	Masonry build, insulated to achieve	0.23
Roof	0.16	Roof insulated to achieve	0.11
Floors	0.18	Beam & Block floor system	0.12
Doors	1.60	Double glazed Low-E, u-PVC frame, Half-glazed door	1.40
Glazing	1.60	Double glazed Low-E, u-PVC frame	1.30

- 3.3.3. Please note that this specification is only draft and is subject to change up until detailed design stage.
- 3.3.4. 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.
- 3.3.5. 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, which is an improvement on the maximum allowable rating in the 2021 Building Regulations.

3.4. Building Services & Renewable Energy (LZCT)

- 3.4.1. 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. AD-L 2021 includes requirements for efficiency and controls of such equipment, including space heating, water heating, ventilation and lighting.
- 3.4.2. 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.
- 3.4.3. For Part L 2021 it is currently proposed to provide heating and hot water via air source heat pumps.
- 3.4.4. After due consideration of the potential LZCT available (shown in Appendix B) the design team propose to the following LZCT which provide benefits / compliance with national and local policies as listed:
- **Air Source Heat Pumps (ASHPs)**
 - No connection to the gas grid;
 - Uses grid electricity as the fuel;
 - Provides 100% space heating and domestic hot water;
 - Minimum co-efficient of performance over 2.5 (250% efficient)
 - ASHP are defined as LZCT. For every 1 kWh of grid electricity consumed they deliver approx. 3kWh into the dwelling (300% efficient). 2kWh is taken from ambient air;
 - Delivers very good performance within Building Regulations assessments;
 - Significant reduction in primary energy demand due to the Coefficient of Performance (COP).
 - **Photovoltaic panels (PV)**
 - Low noise and visual pollution;
 - Efficient low-carbon source of renewable energy.
- 3.4.5. 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.

- 3.4.6. The viability of a heat network was considered for this development, however DHNs (District Heating Networks) are generally suited to developments with high thermal demand, typically provided by sufficient density or a large anchor load, i.e., high-density flats or leisure centres.
- 3.4.7. 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.
- 3.4.8. 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

4. Results (Energy and Carbon)

4.1. Energy from Renewables

- 4.1.1. This development is still at an early design stage and so the full LZCT strategy has not yet been confirmed. Currently, it is proposed to employ Air Source Heat Pumps (ASHPs) to provide space heating and domestic hot water.
- 4.1.2. Photovoltaic (PV) panels are also proposed.
- 4.1.3. As the development already represents a 31% uplift over Part L 2013 simply by complying with Part L 2021, this development goes above and beyond the 5% uplift over Part L 2013 requirement.
- 4.1.4. Table 2 below gives an overview of the results achieved in SAP for this development:

Table 2 – Percentage energy from LZCT

	Detached house
SAP 10 Rating	87B
CO2 emissions	0.57 t/yr
TER kgCO ₂ /yr/m ²	6.9
DER kgCO ₂ /yr/m ²	2.43
Pass by %	64.78%
TPER kWh/m ² /yr	36.58
DPER kWh/m ² /yr	25.56
Pass by %	30.12%
TFEE kWh/m ² /yr	37.93
DFEE kWh/m ² /yr	36.99
Pass by %	2.49%

- 4.1.5. DER refers to Carbon emissions and is the primary metric from Part L 2021. Due to the use of the air source heat pump, the dwelling performs very well, achieving very low Carbon emissions of around 0.6 tCO₂/yr/m². This is a big step towards zero carbon and is a major reduction when viewed against Part L 2013 typical results (16kgCO₂/yr/m²).
- 4.1.6. PER measures the energy needed to provide heating and hot water to a newly built building as well as lighting, ventilation, cooling systems and showers. FEE calculates the total efficiency of the materials used to build the elements of the houses.
- 4.1.7. The SAP 10 results show that the development performs well under all metrics required for Part L 2021 regulations, and achieves excellent results under the DER metric. This is a significant improvement compared to the typical results found in Part L1A 2013.

5. Conclusion

- 5.1.1. This energy statement has been produced to accompany the planning application for the proposed residential site of a single dwelling at Silver Birches.
- 5.1.2. Currently, the following Low and Zero Carbon Technologies (LZCT) are proposed:
- Air Source Heat Pumps (ASHPs)
 - Photovoltaic (PV) panels
- 5.1.3. Waste Water Heat Recovery (WWHR) could also be considered as an option.
- 5.1.4. As dwellings being built to Part L 2021 achieve a 31% uplift over Part L 2013, this development easily meets the 5% uplift over Part L 2013 required by the Three Rivers District Council.
- 5.1.5. As shown in Table 2, the proposed development easily complies with Part L 2021 regulations, achieving low Carbon emissions and giving an uplift of approximately 65% over Part L 2021.
- 5.1.6. A single property is not suitable for district heating, as district heating is generally considered for large developments including a mix of tenures (e.g. commercial, health, housing) which provide a large, regular heat base load.
- 5.1.7. Water efficiency has been reviewed as part of the design process and a Part G compliant specification will be adopted, resulting in the higher standard (lower water use) of 110 litres/person/day.
- 5.1.8. Overheating risk will be assessed in accordance with Approved Document O at a later design stage.
- 5.1.9. The proposed development is found to comply with the requirements of Policy DM4 set out by the Three Rivers District Council.
- 5.1.10. It should be noted that future policies and building regulations may require an update to the measures within this report.

CHARTERS

CHRYN COTTAGE

ROSEHART

HOWLAND

SILVER BIRCHES
OFF 1911

terrace

gravel drive

gravel area

PROPOSED SITE PLAN

LANDSCAPING NOTES:
Shade screening to be made using existing vegetation.
Hardcore paving to be made using gravel and stone.
Reinforced concrete of foundations and concrete base course
to be laid with gravel and stone.

1/200 of A1
Nov. 2023
625 12

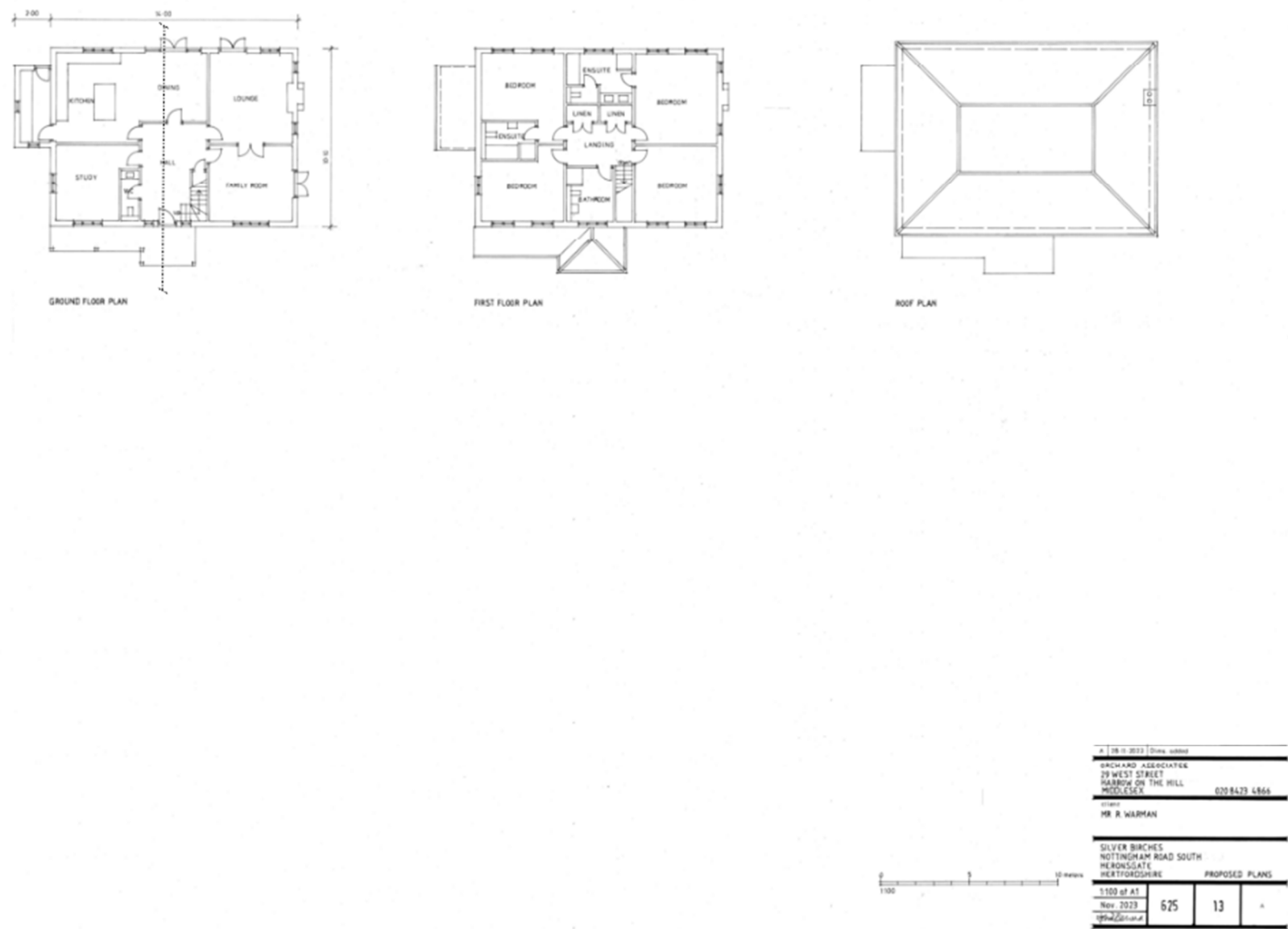
SILVER BIRCHES
NOTTINGHAM ROAD SOUTH
HERONSLATE
HERTFORDSHIRE

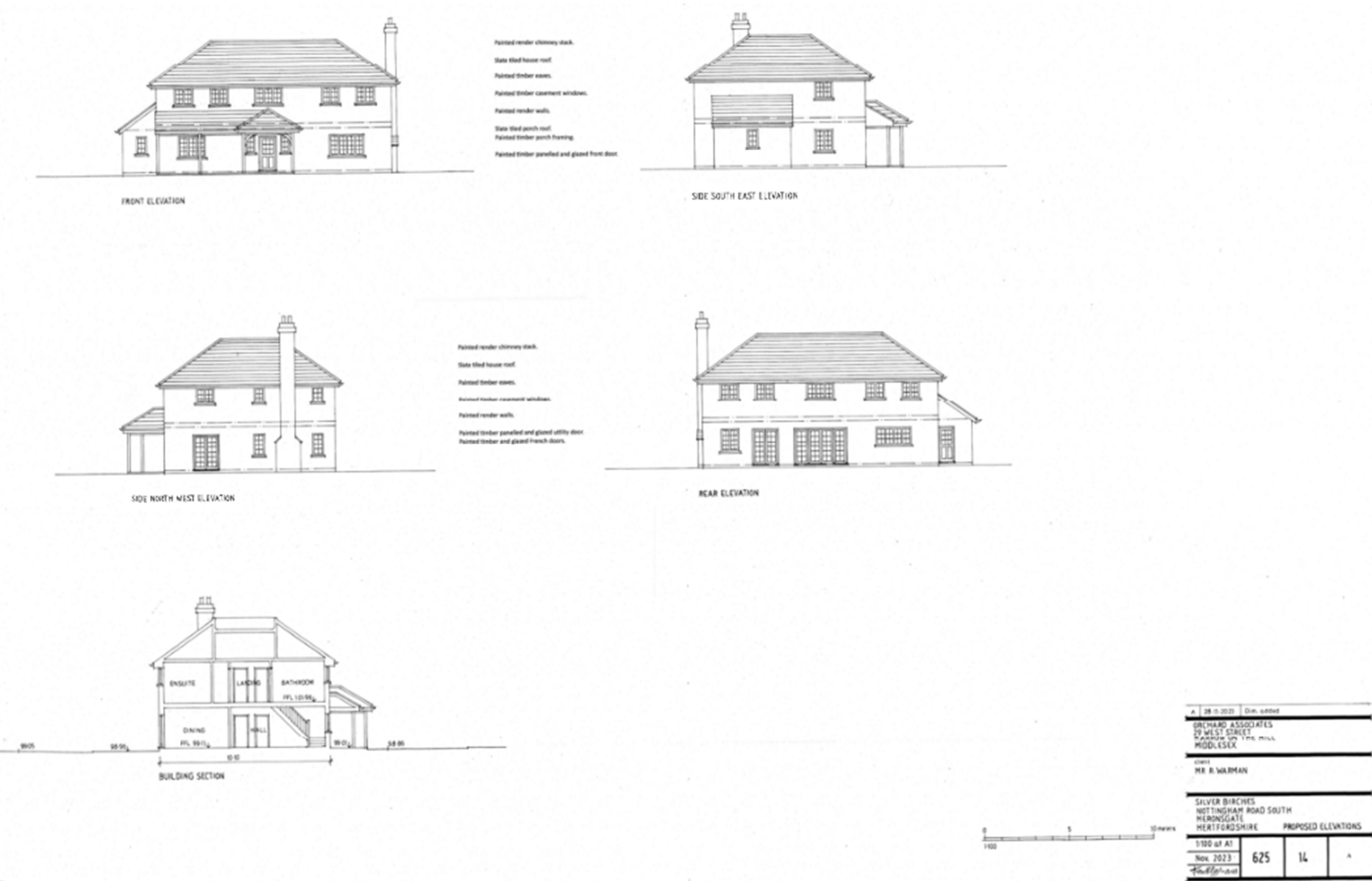
PROPOSED SITE PLAN

1/200 of A1
Nov. 2023
625 12

MR. R. WARMAN

1/200 of A1
Nov. 2023
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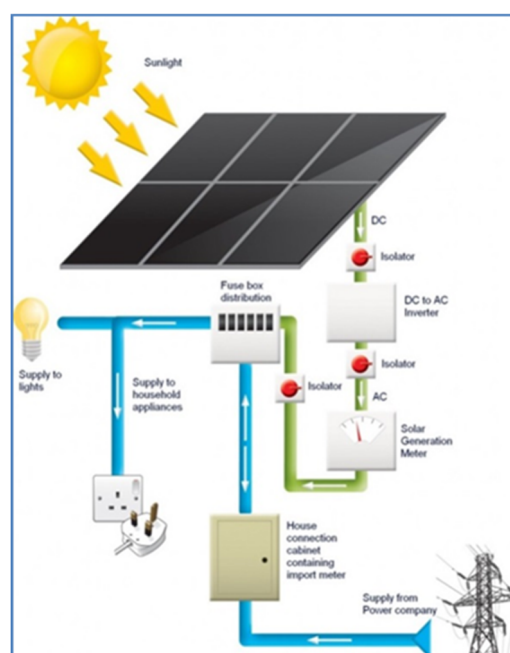
Appendix B – Low and Zero Carbon Technologies

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.

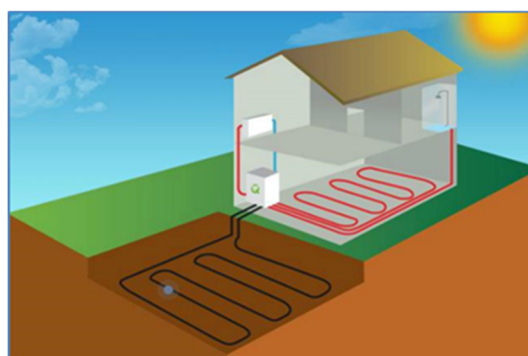
The thermal performance of the unit depends on the outside temperature as well as the unit's Coefficient of Performance. This is the ratio of thermal energy produced to energy used. A typical value for this would be around 3.5, meaning that for every 1kW of electricity consumed the unit would provide 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

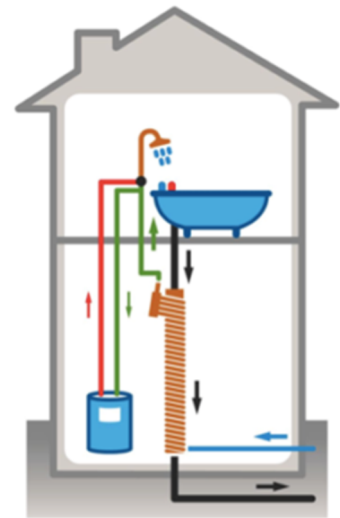
Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as 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.



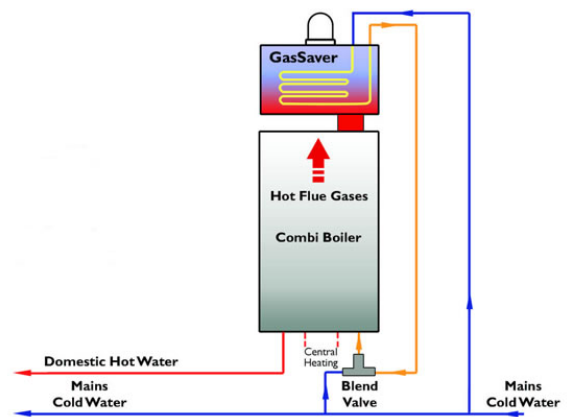
WWHRS

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

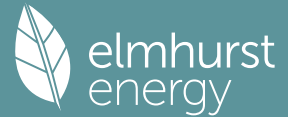
Flue gas heat recovery system (FGHRS) works by recovering waste heat from the flue of a boiler. This waste heat is partially transferred to the main water inlet which raises the temperature of the water which is fed into the boiler. This reduces the amount of energy required to heat the boiler, as it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



Appendix C – SAP Calculations

SAP calculations can be found on the following pages

Full SAP Calculation Printout



Property Reference	Detached house				Issued on Date	22/12/2023
Assessment Reference	House		Prop Type Ref			
Property						
SAP Rating	87 B	DER	2.43	TER	6.90	
Environmental	97 A	% DER < TER				64.78
CO ₂ Emissions (t/year)	0.57	DFEE	36.99	TFEE	37.93	
Compliance Check	See BREL	% DFEE < TFEE				2.49
% DPER < TPER	30.12	DPER	25.56	TPER	36.58	
Assessor Details	Ms. Ruth Ferguson				Assessor ID	AE69-0001
Client						

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (5)

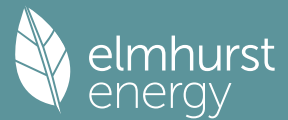
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											4.0000 (17)	
Infiltration rate											0.2000 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] = 0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1850 (21)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (22b)
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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			47.3300	1.2357	58.4876		(27)
Doors			1.9100	1.4000	2.6740		(26a)
Heatloss Floor 1			134.5800	0.1200	16.1496		(28a)
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928		(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327		(30)
Total net area of external elements Aum(A, m ²)			498.7500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	134.4367		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.5000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				33.5500	0.0300		1.0065
E3 Sill				32.6400	0.0310		1.0118
E4 Jamb				84.4000	0.0360		3.0384
E5 Ground floor (normal)				49.6800	0.0590		2.9311

Full SAP Calculation Printout



E6 Intermediate floor within a dwelling	45.7800	0.0060	0.2747
E16 Corner (normal)	19.8000	0.0520	1.0296
E10 Eaves (insulation at ceiling level)	45.7800	0.0890	4.0744
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.3666 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss		(33) + (36) + (36a) =	147.8033 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)			
	Jan	Feb	Mar
(38)m	107.1538	107.1538	107.1538
Heat transfer coeff	254.9571	254.9571	254.9571
Average = Sum(39)m / 12 =	254.9571	254.9571	254.9571
	Jun	Jul	Aug
	107.1538	107.1538	107.1538
	254.9571	254.9571	254.9571
	Sep	Oct	Nov
	107.1538	107.1538	107.1538
	254.9571	254.9571	254.9571
	Dec		
	107.1538		
	254.9571		
HLP	0.9726	0.9726	0.9726
HLP (average)	0.9726	0.9726	0.9726
Days in mont	31	28	31
	30	31	30
	31	30	31
	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0827 (42)
Hot water usage for mixer showers													97.1722 (42a)
Hot water usage for baths													0.0000 (42b)
Hot water usage for other uses													46.2002 (42c)
Average daily hot water use (litres/day)													131.9343 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724	(44)
Energy conte	227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865	(45)
Energy content (annual)													2191.6039
Distribution loss (46)m = 0.15 x (45)m													
	34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730	(46)
Water storage loss:													250.0000 (47)
Store volume													1.3400 (48)
a) If manufacturer declared loss factor is known (kWh/day):													0.5400 (49)
Temperature factor from Table 2b													0.7236 (55)
Enter (49) or (54) in (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	22.5120	23.2624	22.5120	23.2624	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													
	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
12Total per year (kWh/year)													2729.6139 (64)
Electric shower(s)													2730 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
	112.2517	99.5884	106.4573	95.0117	93.0975	84.9598	84.5555	87.2629	87.5161	96.3213	100.8971	111.1970	(65)

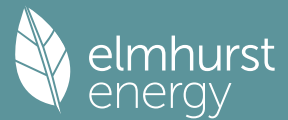
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	219.7830	243.3312	219.7830	227.1091	219.7830	227.1091	219.7830	219.7830	227.1091	219.7830	227.1091	219.7830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	426.8386	431.2679	420.1063	396.3447	366.3499	338.1590	319.3257	314.8965	326.0580	349.8197	379.8145	408.0054	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	(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)													
	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	(71)
Water heating gains (Table 5)													
	150.8760	148.1970	143.0878	131.9608	125.1310	117.9998	113.6499	117.2888	121.5501	129.4642	140.1348	149.4583	(72)
Total internal gains													
	866.7385	892.0370	852.2181	824.6555	780.5048	752.5088	721.9995	721.2092	743.9581	768.3078	816.2993	846.4876	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				14.0500	11.2829	0.7600	0.7000	0.7700	58.4445 (75)				
Southeast				3.5700	36.7938	0.7600	0.7000	0.7700	48.4271 (77)				
Southwest				22.0400	36.7938	0.7600	0.7000	0.7700	298.9727 (79)				
Northwest				7.6700	11.2829	0.7600	0.7000	0.7700	31.9053 (81)				
Solar gains	437.7495	775.6598	1141.0050	1547.3723	1855.1406	1895.3690	1805.0139	1567.2037	1280.4399	878.7622	529.7882	371.0859	(83)
Total gains	1304.4880	1667.6968	1993.2231	2372.0278	2635.6454	2647.8777	2527.0134	2288.4129	2024.3980	1647.0699	1346.0875	1217.5735	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713
alpha	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514
util living area	0.9918	0.9795	0.9520	0.8791	0.7459	0.5735	0.4319	0.4913	0.7309	0.9291	0.9834	0.9936 (86)
Living	19.0885	19.4062	19.8397	20.3552	20.7387	20.9270	20.9805	20.9687	20.8197	20.2769	19.5682	19.0179
Non living	17.8402	18.2442	18.7904	19.4223	19.8625	20.0532	20.0965	20.0894	19.9588	19.3416	18.4533	17.7501
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.0221	19.4062	19.8397	20.3552	20.7387	20.9270	20.9805	20.9687	20.8197	20.2769	19.5682	19.2952 (87)
Th 2	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063 (88)
util rest of house	0.9901	0.9755	0.9427	0.8561	0.7014	0.5060	0.3491	0.4040	0.6684	0.9105	0.9795	0.9923 (89)
MIT 2	19.2029	18.2442	18.7904	19.4223	19.8625	20.0532	20.0965	20.0894	19.9588	19.3416	18.4533	18.1747 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3239	18.4159	18.9455	19.5602	19.9920	20.1823	20.2271	20.2193	20.0860	19.4798	18.6180	18.3403 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3239	18.4159	18.9455	19.5602	19.9920	20.1823	20.2271	20.2193	20.0860	19.4798	18.6180	18.3403 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9883	0.9650	0.9270	0.8396	0.6952	0.5120	0.3606	0.4154	0.6669	0.8940	0.9702	0.9886 (94)
Useful gains	1289.2731	1609.2979	1847.7066	1991.6511	1832.3398	1355.5926	911.1466	950.6840	1349.9957	1472.4923	1306.0293	1203.7536 (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	3830.4616	3445.9863	3173.0649	2717.8853	2114.0970	1423.2462	924.7624	973.7624	1526.1795	2263.9714	2936.6064	3605.1634 (97)
Space heating kWh	1890.6443	1234.2546	986.0666	522.8886	209.6274	0.0000	0.0000	0.0000	0.0000	588.8604	1174.0155	1786.6489 (98a)
Space heating requirement - total per year (kWh/year)												8393.0063
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	1890.6443	1234.2546	986.0666	522.8886	209.6274	0.0000	0.0000	0.0000	0.0000	588.8604	1174.0155	1786.6489 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8393.0063
Space heating per m2										(98c) / (4) =		32.0160 (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 %)												312.0467 (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	1890.6443	1234.2546	986.0666	522.8886	209.6274	0.0000	0.0000	0.0000	0.0000	588.8604	1174.0155	1786.6489 (98)
Space heating efficiency (main heating system 1)	312.0467	312.0467	312.0467	312.0467	312.0467	0.0000	0.0000	0.0000	0.0000	312.0467	312.0467	312.0467 (210)
Space heating fuel (main heating system)	605.8851	395.5353	315.9997	167.5674	67.1782	0.0000	0.0000	0.0000	0.0000	188.7091	376.2308	572.5583 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (64)
Efficiency of water heater (217)m	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071 (216)
Fuel for water heating, kWh/month	153.3905	135.5080	143.6116	125.4583	121.0648	108.4942	106.6489	111.2179	112.8082	126.5055	135.3907	151.6104 (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	11.5784	10.4579	11.5784	11.2049	11.5784	11.2049	11.5784	11.5784	11.2049	11.5784	11.2049	11.5784 (221)
Lighting	56.6219	45.4242	40.8995	29.9647	23.1456	18.9102	21.1142	27.4450	35.6484	46.7726	52.8295	58.1956 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.9209	-26.5938	-42.4114	-52.4089	-60.1979	-56.7132	-56.0069	-50.6195	-41.8806	-32.1412	-19.4495	-14.2898 (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	-2.1136	-5.0097	-10.9717	-18.4675	-26.7636	-28.5321	-28.2187	-23.3737	-16.5750	-8.1416	-3.0972	-1.6596 (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												2689.6639 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												178.2071
Water heating fuel used												1531.7091 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 7.7430, total flow = 45.0000, SFP = 0.1721)												
mechanical ventilation fans (SFP = 0.1721)												136.3265 (230a)
Total electricity for the above, kWh/year												136.3265 (231)

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Electricity for lighting (calculated in Appendix L)	456.9714 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-642.5576 (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	4172.1133 (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	2689.6639	0.1558	419.0248 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1531.7091	0.1410	216.0152 (264)
Space and water heating			635.0400 (265)
Pumps, fans and electric keep-hot	136.3265	0.1387	18.9102 (267)
Energy for lighting	456.9714	0.1443	65.9551 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-469.6335	0.1328	-62.3811
PV Unit electricity exported	-172.9241	0.1223	-21.1556
Total			-83.5368 (269)
Total CO2, kg/year			636.3685 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.4300 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2689.6639	1.5767	4240.8449 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1531.7091	1.5215	2330.4646 (278)
Space and water heating			6571.3095 (279)
Pumps, fans and electric keep-hot	136.3265	1.5128	206.2347 (281)
Energy for lighting	456.9714	1.5338	700.9180 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-469.6335	1.4908	-700.1393
PV Unit electricity exported	-172.9241	0.4489	-77.6192
Total			-777.7586 (283)
Total Primary energy kWh/year			6700.7036 (286)
Dwelling Primary energy Rate (DPER)			25.5600 (287)

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

1. Overall dwelling characteristics

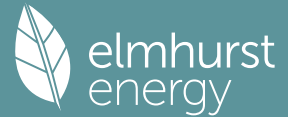
	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0616 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3116 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2882 (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												

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Effective ac	0.3675	0.3603	0.3531	0.3170	0.3098	0.2738	0.2738	0.2666	0.2882	0.3098	0.3243	0.3387 (22b)
	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5573 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9100	1.0000	1.9100		(26a)
TER Opening Type (Uw = 1.20)			47.3300	1.1450	54.1947		(27)
Heatloss Floor 1			134.5800	0.1300	17.4954		(28a)
External Wall 1	236.6000	49.2400	187.3600	0.1800	33.7248		(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327		(30)
Total net area of external elements Aum(A, m ²)			498.7500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 121.3576		(33)

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

144.5000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	33.5500	0.0500	1.6775
E3 Sill	32.6400	0.0500	1.6320
E4 Jamb	84.4000	0.0500	4.2200
E5 Ground floor (normal)	49.6800	0.1600	7.9488
E6 Intermediate floor within a dwelling	45.7800	0.0000	0.0000
E16 Corner (normal)	19.8000	0.0900	1.7820
E10 Eaves (insulation at ceiling level)	45.7800	0.0600	2.7468
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			20.0071 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 141.3647 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	121.6245	121.0626	120.5118	117.9248	117.4407	115.1875	115.1875	114.7703	116.0554	117.4407	118.4199	119.4436 (38)
Average = Sum(39)m / 12 =	262.9892	262.4272	261.8765	259.2894	258.8054	256.5522	256.5522	256.1349	257.4201	258.8054	259.7846	260.8083 (39)
												259.2871

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0032	1.0011	0.9990	0.9891	0.9872	0.9786	0.9786	0.9771	0.9820	0.9872	0.9910	0.9949 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy											3.0827 (42)
Hot water usage for mixer showers											
97.5460	96.0800	93.9439	89.8568	86.8406	83.4769	81.5651	83.6850	86.0089	89.6204	93.7953	97.1722 (42a)
Hot water usage for baths											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses											
46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002 (42c)
Average daily hot water use (litres/day)											131.9343 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724 (44)
Energy conte	227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865 (45)
Energy content (annual)										Total =	Sum(45)m =	2191.6039
Distribution loss (46)m = 0.15 x (45)m												
	34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)

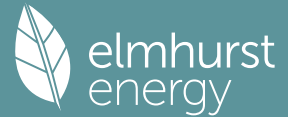
If cylinder contains dedicated solar storage												(56)	
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	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													
	282.5655	249.8061	265.1388	232.4912	224.9588	202.2599	199.2687	207.4110	209.9478	234.6546	250.1914	279.3933	(62)
WWHRS	-44.5939	-39.4392	-41.2985	-34.1968	-31.8702	-27.2715	-25.5627	-27.1834	-28.2162	-33.2638	-37.6838	-43.7681	(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	237.9716	210.3668	223.8403	198.2944	193.0886	174.9884	173.7059	180.2276	181.7316	201.3908	212.5076	235.6252	(64)
Total per year (kWh/year)												2423.7389	(64)
Total per year (kWh/year) = Sum(64)m =												2424	(64)

Heat gains from water heating, kWh/month	119.6220	106.2453	113.8276	102.1442	100.4677	92.0923	91.9258	94.6331	94.6485	103.6916	108.0295	118.5672 (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	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.7830	243.3312	219.7830	227.1091	219.7830	227.1091	219.7830	219.7830	227.1091	219.7830	227.1091	219.7830 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	426.8386	431.2679	420.1063	396.3447	366.3499	338.1590	319.3257	314.8965	326.0580	349.8197	379.8145	408.0054 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136 (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)	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090 (71)
Water heating gains (Table 5)												

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Total internal gains	160.7822	158.1032	152.9940	141.8670	135.0373	127.9060	123.5561	127.1950	131.4563	139.3704	150.0410	159.3645 (72)
	879.6448	904.9432	865.1243	837.5617	793.4110	762.4150	731.9057	731.1154	753.8643	781.2140	829.2055	859.3938 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W

Northeast				14.0500	11.2829		0.6300		0.7000		0.7700		48.4474 (75)
Southeast				3.5700	36.7938		0.6300		0.7000		0.7700		40.1435 (77)
Southwest				22.0400	36.7938		0.6300		0.7000		0.7700		247.8326 (79)
Northwest				7.6700	11.2829		0.6300		0.7000		0.7700		26.4478 (81)

Solar gains	362.8713	642.9812	945.8331	1282.6902	1537.8139	1571.1611	1496.2615	1299.1294	1061.4173	728.4476	439.1665	307.6107	(83)
Total gains	1242.5161	1547.9244	1810.9574	2120.2519	2331.2250	2333.5761	2228.1672	2030.2448	1815.2816	1509.6616	1268.3721	1167.0045	(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	40.0108	40.0965	40.1808	40.5817	40.6576	41.0147	41.0147	41.0815	40.8764	40.6576	40.5044	40.3454
alpha	3.6674	3.6731	3.6787	3.7054	3.7105	3.7343	3.7343	3.7388	3.7251	3.7105	3.7003	3.6897
util living area	0.9930	0.9840	0.9646	0.9098	0.8001	0.6344	0.4861	0.5459	0.7797	0.9450	0.9864	0.9944 (86)
MIT	18.9811	19.2717	19.6876	20.2244	20.6521	20.8960	20.9705	20.9549	20.7679	20.1877	19.4861	18.9360 (87)
Th 2	20.0807	20.0825	20.0842	20.0924	20.0940	20.1012	20.1012	20.1025	20.0984	20.0940	20.0909	20.0876 (88)
util rest of house	0.9916	0.9808	0.9572	0.8909	0.7591	0.5645	0.3949	0.4522	0.7205	0.9296	0.9831	0.9933 (89)
MIT 2	17.6869	18.0583	18.5862	19.2580	19.7620	20.0235	20.0861	20.0776	19.9034	19.2257	18.3393	17.6336 (90)
Living area fraction	17.8782	18.2376	18.7490	19.4008	19.8936	20.1525	20.2168	20.2072	20.0312	19.3679	18.5087	17.8261 (92)
MIT	17.8782	18.2376	18.7490	19.4008	19.8936	20.1525	20.2168	20.2072	20.0312	19.3679	18.5087	17.8261 (93)
Temperature adjustment												0.0000
adjusted MIT	17.8782	18.2376	18.7490	19.4008	19.8936	20.1525	20.2168	20.2072	20.0312	19.3679	18.5087	17.8261 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9863	0.9715	0.9429	0.8734	0.7489	0.5688	0.4071	0.4637	0.7155	0.9135	0.9748	0.9889	(94)
Useful gains	1225.5209	1503.8302	1707.5716	1851.7822	1745.8919	1327.2458	907.0089	941.4504	1298.8287	1379.1325	1236.3942	1154.0585	(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	3570.9108	3500.1427	3207.7254	2722.7484	2120.5400	1424.4958	927.8913	975.1623	1526.8066	2269.1713	2963.8170	3553.7932	(97)
Space heating kWh	1744.9701	1341.5220	1116.1144	627.0957	278.7382	0.0000	0.0000	0.0000	0.0000	662.1888	1243.7444	1785.4026	(98a)
Space heating requirement - total per year (kWh/year)												8799.7762	
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	1744.9701	1341.5220	1116.1144	627.0957	278.7382	0.0000	0.0000	0.0000	0.0000	662.1888	1243.7444	1785.4026	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8799.7762	
Space heating per m2											(98c) / (4) =	33.5677	(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	1744.9701	1341.5220	1116.1144	627.0957	278.7382	0.0000	0.0000	0.0000	0.0000	662.1888	1243.7444	1785.4026 (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)	1890.5418	1453.4366	1209.2247	679.4103	301.9915	0.0000	0.0000	0.0000	0.0000	717.4310	1347.5021	1934.3473 (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	237.9716	210.3668	223.8403	198.2944	193.0886	174.9884	173.7059	180.2276	181.7316	201.3908	212.5076	235.6252 (64)
Efficiency of water heater (217)m	87.6142	87.4629	87.1579	86.4574	84.8823	79.8000	79.8000	79.8000	79.8000	86.5243	87.3622	79.8000 (216)
Fuel for water heating, kWh/month	271.6132	240.5213	256.8215	229.3550	227.4780	219.2837	217.6766	225.8492	227.7338	232.7564	243.2489	268.8327 (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	45.6666	36.6354	32.9861	24.1671	18.6673	15.2514	17.0290	22.1349	28.7510	37.7229	42.6079	46.9358 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-107.0468	-142.2322	-192.6938	-203.6084	-208.8739	-190.9082	-188.1295	-182.3937	-171.3576	-155.7054	-114.3575	-93.5614 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												

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(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	-90.0048	-184.9378	-359.9443	-530.1257	-691.3781	-691.5776	-683.7993	-583.6061	-433.7928	-261.3145	-119.0522	-71.5521	(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												9533.8854	(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												2861.1704	(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)												368.5554	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-6651.9537	(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												6197.6575	(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	9533.8854	0.2100	2002.1159	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2861.1704	0.2100	600.8458	(264)
Space and water heating			2602.9617	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	368.5554	0.1443	53.1939	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1950.8685	0.1359	-265.1948	
PV Unit electricity exported	-4701.0852	0.1265	-594.5527	
Total			-859.7475	(269)
Total CO2, kg/year			1808.3374	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			6.9000	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	9533.8854	1.1300	10773.2905	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2861.1704	1.1300	3233.1225	(278)
Space and water heating			14006.4130	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	368.5554	1.5338	565.3026	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1950.8685	1.5025	-2931.1284	
PV Unit electricity exported	-4701.0852	0.4643	-2182.5325	
Total			-5113.6610	(283)
Total Primary energy kWh/year			9588.1554	(286)
Target Primary Energy Rate (TPER)			36.5800	(287)

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

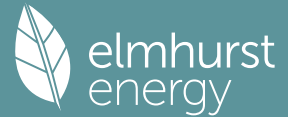
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)	
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)	
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e)... (3n) =	649.4171 (5)	

2. Ventilation rate

	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)

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Number of passive vents
Number of flueless gas fires

0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

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

Air changes per hour
40.0000 / (5) = 0.0616 (8)
Yes
Blower Door
4.0000 (17)
0.2616 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2420 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infiltr rate	0.3085	0.3025	0.2964	0.2662	0.2601	0.2299	0.2299	0.2238	0.2420	0.2601	0.2722	0.2843	(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	0.5476	0.5457	0.5439	0.5354	0.5338	0.5264	0.5264	0.5250	0.5293	0.5338	0.5371	0.5404	(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	
Windows (Uw = 1.30)			47.3300	1.2357	58.4876			(27)
Doors			1.9100	1.4000	2.6740			(26a)
Heatloss Floor 1			134.5800	0.1200	16.1496			(28a)
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928			(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327			(30)
Total net area of external elements Aum(A, m2)			498.7500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 134.4367			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 144.5000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	33.5500	0.0300	1.0065	
E3 Sill	32.6400	0.0310	1.0118	
E4 Jamb	84.4000	0.0360	3.0384	
E5 Ground floor (normal)	49.6800	0.0590	2.9311	
E6 Intermediate floor within a dwelling	45.7800	0.0060	0.2747	
E16 Corner (normal)	19.8000	0.0520	1.0296	
E10 Eaves (insulation at ceiling level)	45.7800	0.0890	4.0744	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3666 (36)

Point Thermal bridges

Total fabric heat loss (33) + (36) + (36a) = 147.8033 (37)

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

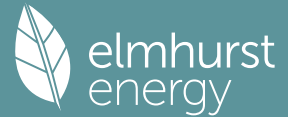
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	117.3530	116.9570	116.5688	114.7454	114.4042	112.8161	112.8161	112.5220	113.4278	114.4042	115.0944	115.8159	(38)
Heat transfer coeff	265.1563	264.7603	264.3721	262.5487	262.2075	260.6194	260.6194	260.3253	261.2311	262.2075	262.8977	263.6192	(39)
Average = Sum(39)m / 12 =												262.5471	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0115	1.0100	1.0085	1.0015	1.0002	0.9942	0.9942	0.9930	0.9965	1.0002	1.0029	1.0056	(40)
HLP (average)												1.0015	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0827 (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	32.7657	32.2791	31.5939	30.3304	29.3843	28.3352	27.7686	28.4490	29.1899	30.3125	31.6020	32.6550	(42b)
Hot water usage for other uses	46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002	(42c)
Average daily hot water use (litres/day)												72.3792	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	78.9659	76.7993	74.4340	71.4905	68.8644	66.1354	65.5687	67.9292	70.3501	73.1526	76.1222	78.8552	(44)
Energy conte	125.0627	109.3612	114.4023	97.8670	92.7048	81.3211	79.2997	84.1105	86.7487	99.2674	108.4500	123.4681	(45)
Energy content (annual)										Total = Sum(45)m =		1202.0635	
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													
106.3033 92.9570 97.2420 83.1869 78.7991 69.1230 67.4047 71.4939 73.7364 84.3773 92.1825 104.9479													(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	106.3033	92.9570	97.2420	83.1869	78.7991	69.1230	67.4047	71.4939	73.7364	84.3773	92.1825	104.9479	(64)
Total per year (kWh/year) = Sum(64)m =												1021.7540	(64)
Electric shower(s)	60.7889	54.1634	59.1444	56.4407	57.4998	54.8493	56.6776	57.4998	56.4407	59.1444	58.0322	60.7889	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												691.4701	(64a)
Heat gains from water heating, kWh/month	41.7731	36.7801	39.0966	34.9069	34.0747	30.9931	31.0206	32.2484	32.5443	35.8804	37.5537	41.4342	(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	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.7830	243.3312	219.7830	227.1091	219.7830	227.1091	219.7830	219.7830	227.1091	219.7830	227.1091	219.7830	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	426.8386	431.2679	420.1063	396.3447	366.3499	338.1590	319.3257	314.8965	326.0580	349.8197	379.8145	408.0054	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	(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)	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	(71)
Water heating gains (Table 5)	56.1466	54.7323	52.5492	48.4818	45.7994	43.0459	41.6943	43.3447	45.2004	48.2264	52.1579	55.6911	(72)
Total internal gains	772.0091	798.5723	761.6794	741.1765	701.1731	677.5549	650.0439	647.2651	667.6084	687.0700	728.3224	752.7204	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				14.0500	11.2829		0.7600		0.7000		0.7700		58.4445 (75)	
Southeast				3.5700	36.7938		0.7600		0.7000		0.7700		48.4271 (77)	
Southwest				22.0400	36.7938		0.7600		0.7000		0.7700		298.9727 (79)	
Northwest				7.6700	11.2829		0.7600		0.7000		0.7700		31.9053 (81)	
Solar gains	437.7495	775.6598	1141.0050	1547.3723	1855.1406	1895.3690	1805.0139	1567.2037	1280.4399	878.7622	529.7882	371.0859 (83)		
Total gains	1209.7586	1574.2321	1902.6845	2288.5489	2556.3137	2572.9239	2455.0578	2214.4688	1948.0483	1565.8321	1258.1106	1123.8064 (84)		

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6838	39.7432	39.8015	40.0779	40.1301	40.3746	40.3746	40.4202	40.2801	40.1301	40.0247	39.9152	21.0000 (85)
alpha	3.6456	3.6495	3.6534	3.6719	3.6753	3.6916	3.6916	3.6947	3.6853	3.6753	3.6683	3.6610	
util living area	0.9936	0.9832	0.9595	0.8930	0.7672	0.5953	0.4517	0.5136	0.7550	0.9401	0.9868	0.9951	(86)
MIT	18.9425	19.2678	19.7184	20.2753	20.6946	20.9127	20.9757	20.9615	20.7876	20.1971	19.4574	18.8851	(87)
Th 2	20.0738	20.0750	20.0763	20.0821	20.0832	20.0882	20.0891	20.0863	20.0863	20.0832	20.0810	20.0787	(88)
util rest of house	0.9923	0.9798	0.9512	0.8715	0.7232	0.5257	0.3643	0.4222	0.6931	0.9235	0.9836	0.9941	(89)
MIT 2	18.1719	18.4957	18.9405	19.4800	19.8597	20.0384	20.0787	20.0729	19.9495	19.4175	18.6903	18.1182	(90)
Living area fraction	18.2857	18.6098	19.0555	19.5976	19.9830	20.1676	20.2113	20.2042	20.0733	19.5327	18.8036	18.2315	(91)
MIT	18.2857	18.6098	19.0555	19.5976	19.9830	20.1676	20.2113	20.2042	20.0733	19.5327	18.8036	18.2315	(92)
Temperature adjustment	18.2857	18.6098	19.0555	19.5976	19.9830	20.1676	20.2113	20.2042	20.0733	19.5327	18.8036	18.2315	(93)
adjusted MIT	18.2857	18.6098	19.0555	19.5976	19.9830	20.1676	20.2113	20.2042	20.0733	19.5327	18.8036	18.2315	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9886	0.9726	0.9396	0.8582	0.7180	0.5321	0.3764	0.4343	0.6922	0.9110	0.9774	0.9911	(94)
Useful gains	1195.9525	1531.0771	1787.7397	1964.1240	1835.3822	1369.0870	924.1375	961.6812	1348.3636	1426.4700	1229.7065	1113.7850	(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	3708.4077	3629.8126	3319.3128	2808.6280	2171.8776	1451.0319	941.1745	990.3322	1560.4210	2342.2131	3076.8620	3698.9813	(97)
Space heating kWh	1869.2667	1410.3503	1139.4904	608.0429	250.3526	0.0000	0.0000	0.0000	0.0000	681.3129	1329.9519	1923.3861	(98a)
Space heating requirement - total per year (kWh/year)												9212.1537	
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	1869.2667	1410.3503	1139.4904	608.0429	250.3526	0.0000	0.0000	0.0000	0.0000	681.3129	1329.9519	1923.3861	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9212.1537	
Space heating per m2										(98c) / (4) =		35.1408	(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	2449.8226	1928.5837	1978.4725	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8478	0.9021	0.8670	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2076.8921	1739.7163	1715.3546	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2900.5908	2767.0688	2490.3787	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	593.0631	764.3502	576.6179	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	148.2658	191.0876	144.1545	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												483.5078	(107)
Energy for space heating												35.1408	(99)
Energy for space cooling												1.8444	(108)
Total												36.9852	(109)
Fabric Energy Efficiency (DFEE)												37.0	(109)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c)	40.0000 / (5) = 0.0616 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3116 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2882 (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	0.3675	0.3603	0.3531	0.3170	0.3098	0.2738	0.2738	0.2666	0.2882	0.3098	0.3243	0.3387 (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	0.5675	0.5649	0.5623	0.5503	0.5480	0.5375	0.5375	0.5355	0.5415	0.5480	0.5526	0.5573 (25)

3. Heat losses and heat loss parameter

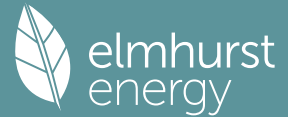
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Semi-glazed door			1.9100	1.0000	1.9100		(26a)
TER Opening Type (Uw = 1.20)			47.3300	1.1450	54.1947		(27)
Heatloss Floor 1			134.5800	0.1300	17.4954		(28a)
External Wall 1	236.6000	49.2400	187.3600	0.1800	33.7248		(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327		(30)
Total net area of external elements Aum(A, m ²)			498.7500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 121.3576		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.5000 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				33.5500	0.0500	1.6775	
E3 Sill				32.6400	0.0500	1.6320	
E4 Jamb				84.4000	0.0500	4.2200	
E5 Ground floor (normal)				49.6800	0.1600	7.9488	
E6 Intermediate floor within a dwelling				45.7800	0.0000	0.0000	
E16 Corner (normal)				19.8000	0.0900	1.7820	
E10 Eaves (insulation at ceiling level)				45.7800	0.0600	2.7468	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)						20.0071 (36)	
Point Thermal bridges						(36a) = 0.0000	
Total fabric heat loss						(33) + (36) + (36a) = 141.3647 (37)	

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	121.6245	121.0626	120.5118	117.9248	117.4407	115.1875	115.1875	114.7703	116.0554	117.4407	118.4199	119.4436 (38)
Average = Sum(39)m / 12 =	262.9892	262.4272	261.8765	259.2894	258.8054	256.5522	256.5522	256.1349	257.4201	258.8054	259.7846	260.8083 (39)
												259.2871
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0032	1.0011	0.9990	0.9891	0.9872	0.9786	0.9786	0.9771	0.9820	0.9872	0.9910	0.9949 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0827 (42)
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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	32.7657	32.2791	31.5939	30.3304	29.3843	28.3352	27.7686	28.4490	29.1899	30.3125	31.6020	32.6550 (42b)
Hot water usage for other uses	46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002 (42c)
Average daily hot water use (litres/day)												72.3792 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	78.9659	76.7993	74.4340	71.4905	68.8644	66.1354	65.5687	67.9292	70.3501	73.1526	76.1222	78.8552 (44)
Distribution loss (46)m = 0.15 x (45)m	125.0627	109.3612	114.4023	97.8670	92.7048	81.3211	79.2997	84.1105	86.7487	99.2674	108.4500	123.4681 (45)
Water 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 (46)
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	106.3033	92.9570	97.2420	83.1869	78.7991	69.1230	67.4047	71.4939	73.7364	84.3773	92.1825	104.9479 (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	106.3033	92.9570	97.2420	83.1869	78.7991	69.1230	67.4047	71.4939	73.7364	84.3773	92.1825	104.9479 (64)
12Total per year (kWh/year)												1021.7540 (64)
Electric shower(s)	60.7889	54.1634	59.1444	56.4407	57.4998	54.8493	56.6776	57.4998	56.4407	59.1444	58.0322	60.7889 (64a)
Heat gains from water heating, kWh/month	41.7731	36.7801	39.0966	34.9069	34.0747	30.9931	31.0206	32.2484	32.5443	35.8804	37.5537	41.4342 (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	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362	154.1362 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	219.7830	243.3312	219.7830	227.1091	219.7830	227.1091	219.7830	219.7830	227.1091	219.7830	227.1091	219.7830 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	426.8386	431.2679	420.1063	396.3447	366.3499	338.1590	319.3257	314.8965	326.0580	349.8197	379.8145	408.0054 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136	38.4136 (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)	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090 (71)
Water heating gains (Table 5)	56.1466	54.7323	52.5492	48.4818	45.7994	43.0459	41.6943	43.3447	45.2004	48.2264	52.1579	55.6911 (72)
Total internal gains	772.0091	798.5723	761.6794	741.1765	701.1731	677.5549	650.0439	647.2651	667.6084	687.0700	728.3224	752.7204 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	

Northeast				14.0500	11.2829	0.6300	0.7000	0.7700			48.4474	(75)	
Southeast				3.5700	36.7938	0.6300	0.7000	0.7700			40.1435	(77)	
Southwest				22.0400	36.7938	0.6300	0.7000	0.7700			247.8326	(79)	
Northwest				7.6700	11.2829	0.6300	0.7000	0.7700			26.4478	(81)	

Solar gains	362.8713	642.9812	945.8331	1282.6902	1537.8139	1571.1611	1496.2615	1299.1294	1061.4173	728.4476	439.1665	307.6107	(83)
Total gains	1134.8804	1441.5535	1707.5125	2023.8667	2238.9871	2248.7160	2146.3054	1946.3945	1729.0257	1415.5175	1167.4889	1060.3311	(84)

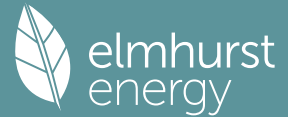
7. Mean internal temperature (heating season)

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	40.0108	40.0965	40.1808	40.5817	40.6576	41.0147	41.0147	41.0815	40.8764	40.6576	40.5044	40.3454
alpha	3.6674	3.6731	3.6787	3.7054	3.7105	3.7343	3.7343	3.7388	3.7251	3.7105	3.7003	3.6897
util living area	0.9948	0.9872	0.9702	0.9199	0.8152	0.6515	0.5022	0.5650	0.7988	0.9541	0.9896	0.9960 (86)
MIT	18.9141	19.2077	19.6299	20.1812	20.6265	20.8862	20.9672	20.9495	20.7460	20.1388	19.4247	18.8690 (87)
Th 2	20.0807	20.0825	20.0842	20.0924	20.0940	20.1012	20.1012	20.1025	20.0984	20.0940	20.0909	20.0876 (88)
util rest of house	0.9937	0.9846	0.9639	0.9025	0.7757	0.5815	0.4089	0.4697	0.7417	0.9408	0.9870	0.9951 (89)
MIT 2	18.1485	18.4418	18.8607	19.4021	19.8142	20.0344	20.0880	20.0805	19.9301	19.3713	18.6651	18.1085 (90)
Living area fraction									fLA = Living area / (4) =			0.1478 (91)
MIT	18.2617	18.5550	18.9744	19.5173	19.9342	20.1603	20.2179	20.2089	20.0506	19.4847	18.7774	18.2209 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2617	18.5550	18.9744	19.5173	19.9342	20.1603	20.2179	20.2089	20.0506	19.4847	18.7774	18.2209 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9906	0.9786	0.9539	0.8893	0.7678	0.5864	0.4215	0.4816	0.7382	0.9293	0.9818	0.9926 (94)
Ext temp.	1124.2611	1410.7260	1628.7968	1799.7590	1719.1641	1318.6786	904.7112	937.3557	1276.4316	1315.4053	1146.2755	1052.4924 (95)
	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)

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Heat loss rate W	3671.7675	3583.4329	3266.7530	2752.9431	2131.0576	1426.4991	928.1750	975.5897	1531.8130	2299.4109	3033.6003	3656.7721	(97)
Space heating kWh	1895.3448	1460.0590	1218.6394	686.2926	306.4488	0.0000	0.0000	0.0000	0.0000	732.1002	1358.8738	1937.5841	(98a)
Space heating requirement - total per year (kWh/year)												9595.3427	
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	1895.3448	1460.0590	1218.6394	686.2926	306.4488	0.0000	0.0000	0.0000	0.0000	732.1002	1358.8738	1937.5841	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9595.3427	
Space heating per m2												36.6025	(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	2411.5905	1898.4861	1946.6254	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8060	0.8709	0.8307	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1943.7600	1653.3263	1617.0569	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2521.6466	2406.1894	2177.0451	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	416.0783	560.1301	416.6312	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction									fc = cooled area / (4) =				(105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	104.0196	140.0325	104.1578	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												348.2099	(107)
Energy for space heating												36.6025	(99)
Energy for space cooling												1.3283	(108)
Total												37.9308	(109)
Fabric Energy Efficiency (TFEE)												37.9	(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	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)	
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	649.4171 (5)	

2. Ventilation rate

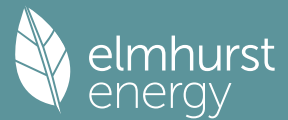
	m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - decentralised												0.5000	(23a)
If mechanical ventilation												0.5000	(23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													
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
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Windows (Uw = 1.30)			47.3300	1.2357	58.4876	(27)
Doors			1.9100	1.4000	2.6740	(26a)
Heatloss Floor 1			134.5800	0.1200	16.1496	(28a)
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928	(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327	(30)
Total net area of external elements Aum(A, m2)			498.7500			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	134.4367		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 144.5000 (35)

List of Thermal Bridges						
K1 Element			Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)			33.5500	0.0300	1.0065	
E3 Sill			32.6400	0.0310	1.0118	
E4 Jamb			84.4000	0.0360	3.0384	
E5 Ground floor (normal)			49.6800	0.0590	2.9311	
E6 Intermediate floor within a dwelling			45.7800	0.0060	0.2747	
E16 Corner (normal)			19.8000	0.0520	1.0296	
E10 Eaves (insulation at ceiling level)			45.7800	0.0890	4.0744	

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.3666 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 147.8033 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538
Average = Sum(39)m / 12 =	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571

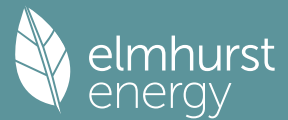
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.0827 (42)
Hot water usage for mixer showers												
Hot water usage for baths	97.5460	96.0800	93.9439	89.8568	86.8406	83.4769	81.5651	83.6850	86.0089	89.6204	93.7953	97.1722 (42a)
Hot water usage for other uses	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Average daily hot water use (litres/day)	46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002 (42c)
Daily hot water use	143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724 (44)
Energy content (annual)	227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865 (45)
Distribution loss (46)m = 0.15 x (45)m	34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730 (46)
Water storage loss:												
Store volume												250.0000 (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	22.5120	23.2624	22.5120	23.2624	23.2624 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	112.2517	99.5884	106.4573	95.0117	93.0975	84.9598	84.5555	87.2629	87.5161	96.3213	100.8971	111.1970 (65)

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6890	57.4562	46.7265	35.3750	26.4432	22.3245	24.1224	31.3552	42.0849	53.4364	62.3682	66.4869 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	637.0726	643.6834	627.0244	591.5592	546.7908	504.7149	476.6055	469.9947	486.6538	522.1189	566.8873	608.9633 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791 (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)	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090 (71)
Water heating gains (Table 5)	150.8760	148.1970	143.0878	131.9608	125.1310	117.9998	113.6499	117.2888	121.5501	129.4642	140.1348	149.4583 (72)
Total internal gains	970.8712	967.5702	935.0723	877.1286	816.5987	763.2727	732.6114	736.8723	768.5223	823.2531	887.6239	943.1421 (73)

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

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	W/m2		or Table 6b		or Table 6c		Table 6d		
Northeast		14.0500		11.2829		0.7600		0.7700	58.4445 (75)
Southeast		3.5700		36.7938		0.7600		0.7700	48.4271 (77)
Southwest		22.0400		36.7938		0.7600		0.7700	298.9727 (79)
Northwest		7.6700		11.2829		0.7600		0.7700	31.9053 (81)

Solar gains	437.7495	775.6598	1141.0050	1547.3723	1855.1406	1895.3690	1805.0139	1567.2037	1280.4399	878.7622	529.7882	371.0859 (83)
Total gains	1408.6207	1743.2300	2076.0773	2424.5009	2671.7393	2658.6417	2537.6253	2304.0760	2048.9622	1702.0152	1417.4121	1314.2280 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713
alpha	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514
util living area	0.9894	0.9764	0.9462	0.8728	0.7401	0.5716	0.4303	0.4883	0.7256	0.9227	0.9805	0.9917 (86)
Living	19.1529	19.4505	19.8827	20.3752	20.7460	20.9278	20.9807	20.9693	20.8243	20.3028	19.6108	19.0782
Non living	17.9223	18.3001	18.8434	19.4453	19.8698	20.0538	20.0966	20.0897	19.9630	19.3722	18.5069	17.8271
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.0551	19.4505	19.8827	20.3752	20.7460	20.9278	20.9807	20.9693	20.8243	20.3028	19.6108	19.3471 (87)
Th 2	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063 (88)
util rest of house	0.9873	0.9719	0.9359	0.8490	0.6953	0.5042	0.3477	0.4014	0.6629	0.9028	0.9760	0.9901 (89)
MIT 2	19.2356	18.3001	18.8434	19.4453	19.8698	20.0538	20.0966	20.0897	19.9630	19.3722	18.5069	18.2378 (90)
Living area fraction									fLA = Living area / (4) =			0.1478 (91)
MIT	19.3567	18.4701	18.9970	19.5827	19.9993	20.1829	20.2273	20.2197	20.0902	19.5097	18.6700	18.4017 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3567	18.4701	18.9970	19.5827	19.9993	20.1829	20.2273	20.2197	20.0902	19.5097	18.6700	18.4017 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9851	0.9606	0.9196	0.8328	0.6894	0.5102	0.3591	0.4129	0.6616	0.8862	0.9657	0.9857 (94)
Useful gains	1387.6997	1674.4853	1909.2491	2019.2215	1842.0064	1356.5052	911.3645	951.2574	1355.6448	1508.3860	1368.8229	1295.3815 (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	3838.8096	3459.7871	3186.2014	2723.6370	2115.9699	1423.4095	924.8003	973.8629	1527.2563	2271.5926	2949.8620	3620.8272 (97)
Space heating kWh	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98a)
Space heating requirement - total per year (kWh/year)												8120.7145
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	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8120.7145
Space heating per m2										(98c) / (4) =		30.9774 (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 %)												312.0467 (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	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98)
Space heating efficiency (main heating system 1)	312.0467	312.0467	312.0467	312.0467	312.0467	0.0000	0.0000	0.0000	0.0000	312.0467	312.0467	312.0467 (210)
Space heating fuel (main heating system)	584.4081	384.4690	304.4585	162.5331	65.3200	0.0000	0.0000	0.0000	0.0000	181.9682	364.8006	554.4464 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (64)
Efficiency of water heater	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071 (216)
Fuel for water heating, kWh/month	153.3905	135.5080	143.6116	125.4583	121.0648	108.4942	106.6489	111.2179	112.8082	126.5055	135.3907	151.6104 (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	11.5784	10.4579	11.5784	11.2049	11.5784	11.2049	11.5784	11.5784	11.2049	11.5784	11.2049	11.5784 (231)
Lighting	56.6219	45.4242	40.8995	29.9647	23.1456	18.9102	21.1142	27.4450	35.6484	46.7726	52.8295	58.1956 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-16.9042	-26.5686	-42.3532	-52.3564	-60.1654	-56.7132	-56.0069	-50.6195	-41.8806	-32.1090	-19.4326	-14.2782 (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	-2.1304	-5.0350	-11.0299	-18.5200	-26.7961	-28.5321	-28.2187	-23.3737	-16.5750	-8.1738	-3.1140	-1.6712 (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)

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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												2602.4040	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.2071	
Water heating fuel used												1531.7091	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 7.7430, total flow = 45.0000, SFP = 0.1721)													
mechanical ventilation fans (SFP = 0.1721)												136.3265	(230a)
Total electricity for the above, kWh/year												136.3265	(231)
Electricity for lighting (calculated in Appendix L)												456.9714	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-642.5576	(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												4084.8533	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2602.4040	16.4900	429.1364 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1531.7091	16.4900	252.5788 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	136.3265	16.4900	22.4802 (249)
Energy for lighting	456.9714	16.4900	75.3546 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-469.3877	16.4900	-77.4020
PV Unit electricity exported	-173.1699	5.5900	-9.6802
Total			-87.0822 (252)
Total energy cost			692.4678 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.8116 (257)
SAP value		86.8437
SAP rating (Section 12)		87 (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	2602.4040	0.1558	405.4275 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1531.7091	0.1410	216.0152 (264)
Space and water heating			621.4427 (265)
Pumps, fans and electric keep-hot	136.3265	0.1387	18.9102 (267)
Energy for lighting	456.9714	0.1443	65.9551 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-469.3877	0.1328	-62.3448
PV Unit electricity exported	-173.1699	0.1224	-21.1957
Total			-83.5405 (269)
Total CO2, kg/year			622.7674 (272)
CO2 emissions per m2			2.3800 (273)
EI value			97.2831
EI rating			97 (274)
EI band			A

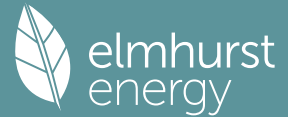
SAP 10 WORKSHEET FOR New Build (As Designed) (Version 10.2, February 2022)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (5)

2. Ventilation rate

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												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												0 * 10 = 0.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
												Air changes per hour
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) = 0.0000 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												4.0000 (17)
Infiltration rate												0.2000 (18)
Number of sides sheltered												1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =											0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1850 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
	0.1943	0.1850	0.1850	0.1711	0.1711	0.1526	0.1573	0.1480	0.1526	0.1619	0.1619	0.1758 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
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					
Windows (Uw = 1.30)			47.3300	1.2357	58.4876							
Doors			1.9100	1.4000	2.6740							
Heatloss Floor 1			134.5800	0.1200	16.1496							
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928							
External Roof 1	127.5700		127.5700	0.1100	14.0327							
Total net area of external elements Aum(A, m2)			498.7500									
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =				134.4367					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K												144.5000 (35)
List of Thermal Bridges												
K1 Element					Length	Psi-value	Total					
E2 Other lintels (including other steel lintels)					33.5500	0.0300	1.0065					
E3 Sill					32.6400	0.0310	1.0118					
E4 Jamb					84.4000	0.0360	3.0384					
E5 Ground floor (normal)					49.6800	0.0590	2.9311					
E6 Intermediate floor within a dwelling					45.7800	0.0060	0.2747					
E16 Corner (normal)					19.8000	0.0520	1.0296					
E10 Eaves (insulation at ceiling level)					45.7800	0.0890	4.0744					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.3666	(36)				
Point Thermal bridges							(36a) =	0.0000				
Total fabric heat loss							(33) + (36) + (36a) =	147.8033 (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	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538 (38)
Heat transfer coeff	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571 (39)
Average = Sum(39)m / 12 =												254.9571
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												

Assumed occupancy												3.0827 (42)
Hot water usage for mixer showers	97.5460	96.0800	93.9439	89.8568	86.8406	83.4769	81.5651	83.6850	86.0089	89.6204	93.7953	97.1722 (42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42b)
Hot water usage for other uses	46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002 (42c)
Average daily hot water use (litres/day)												131.9343 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724 (44)
Energy conte	227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865 (45)
Energy content (annual)												Total = Sum(45)m = 2191.6039
Distribution loss (46)m = 0.15 x (45)m	34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730 (46)
Water storage loss:												250.0000 (47)
Store volume												1.3400 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7236 (55)
Enter (49) or (54) in (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												

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WWHRS	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	112.2517	99.5884	106.4573	95.0117	93.0975	84.9598	84.5555	87.2629	87.5161	96.3213	100.8971	111.1970 (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	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.6890	57.4562	46.7265	35.3750	26.4432	22.3245	24.1224	31.3552	42.0849	53.4364	62.3682	66.4869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	637.0726	643.6834	627.0244	591.5592	546.7908	504.7149	476.6055	469.9947	486.6538	522.1189	566.8873	608.9633	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	(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)	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	(71)
Water heating gains (Table 5)	150.8760	148.1970	143.0878	131.9608	125.1310	117.9998	113.6499	117.2888	121.5501	129.4642	140.1348	149.4583	(72)
Total internal gains	970.8712	967.5702	935.0723	877.1286	816.5987	763.2727	732.6114	736.8723	768.5223	823.2531	887.6239	943.1421	(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
<hr/>												
Northeast					14.0500	12.9236		0.7600	0.7000	0.7700		66.9427 (75)
Southeast					3.5700	40.4699		0.7600	0.7000	0.7700		53.2654 (77)
Southwest					22.0400	40.4699		0.7600	0.7000	0.7700		328.8431 (79)
Northwest					7.6700	12.9236		0.7600	0.7000	0.7700		36.5445 (81)
<hr/>												
Solar gains	485.5958	776.0712	1133.0114	1592.4113	1866.5041	2043.1049	1923.7995	1703.8348	1381.3864	940.2430	602.4279	407.4689 (83)
Total gains	1456.4670	1743.6414	2068.0837	2469.5398	2683.1028	2806.3776	2656.4109	2440.7071	2149.9087	1763.4961	1490.0518	1350.6110 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713
alpha	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514
util living area	0.9861	0.9730	0.9365	0.8397	0.6707	0.4411	0.2953	0.3306	0.6244	0.8911	0.9719	0.9891 (86)
Living	19.3119	19.5620	20.0128	20.5122	20.8451	20.9762	20.9962	20.9942	20.9120	20.4678	19.7965	19.2472
Non living	18.1253	18.4419	19.0065	19.6076	19.9742	20.0927	20.1052	20.1045	20.0448	19.5703	18.7422	18.0432
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1364	19.5620	20.0128	20.5122	20.8451	20.9762	20.9962	20.9942	20.9120	20.4678	19.7965	19.4924 (87)
Th 2	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063 (88)
util rest of house	0.9833	0.9676	0.9238	0.8097	0.6158	0.3672	0.2113	0.2400	0.5473	0.8626	0.9652	0.9869 (89)
MIT 2	19.3165	18.4419	19.0065	19.6076	19.9742	20.0927	20.1052	20.1045	20.0448	19.5703	18.7422	18.4150 (90)
Living area fraction									fLA = Living area / (4) =			0.1478 (91)
MIT	19.4377	18.6074	19.1552	19.7413	20.1029	20.2233	20.2368	20.2360	20.1730	19.7030	18.8980	18.5742 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4377	18.6074	19.1552	19.7413	20.1029	20.2233	20.2368	20.2360	20.1730	19.7030	18.8980	18.5742 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9807	0.9554	0.9070	0.7958	0.6156	0.3771	0.2236	0.2533	0.5534	0.8471	0.9528	0.9815 (94)	
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)	
Heat loss rate W	3655.4967	3316.3246	2997.0692	2509.0969	1810.9390	1076.7494	595.7962	621.0680	1267.8938	2065.9101	2778.5295	3435.3394 (97)	
Space heating kWh	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325 (98a)	
Space heating requirement - total per year (kWh/year)												7084.2236	
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	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												7084.2236	
Space heating per m2										(98c) / (4) =		27.0235 (99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
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Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												312.0467	(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	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325	(98)
Space heating efficiency (main heating system 1)	312.0467	312.0467	312.0467	312.0467	312.0467	0.0000	0.0000	0.0000	0.0000	312.0467	312.0467	312.0467	(210)
Space heating fuel (main heating system)	531.0078	355.4370	267.3622	125.5028	37.9825	0.0000	0.0000	0.0000	0.0000	136.4078	313.5327	503.0121	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
Efficiency of water heater	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	(216)
Fuel for water heating, kWh/month	153.3905	135.5080	143.6116	125.4583	121.0648	108.4942	106.6489	111.2179	112.8082	126.5055	135.3907	151.6104	(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	11.5784	10.4579	11.5784	11.2049	11.5784	11.2049	11.5784	11.5784	11.2049	11.5784	11.2049	11.5784	(231)
Lighting	56.6219	45.4242	40.8995	29.9647	23.1456	18.9102	21.1142	27.4450	35.6484	46.7726	52.8295	58.1956	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-18.7437	-26.7013	-42.0447	-53.1851	-59.7953	-59.9657	-58.7062	-54.0331	-44.6623	-34.0255	-21.9603	-15.6953	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-2.5698	-5.1655	-11.1729	-19.6923	-27.3869	-31.5314	-30.7019	-26.2335	-18.5251	-9.3576	-3.9095	-1.9872	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2270.2450	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.2071	
Water heating fuel used												1531.7091	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 7.7430, total flow = 45.0000, SFP = 0.1721)													
mechanical ventilation fans (SFP = 0.1721)												136.3265	(230a)
Total electricity for the above, kWh/year												136.3265	(231)
Electricity for lighting (calculated in Appendix L)												456.9714	(232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV generation												-677.7522	(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												3717.4997	(238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2270.2450	21.5100	488.3297	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1531.7091	21.5100	329.4706	(247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000	(247a)
Pumps, fans and electric keep-hot	136.3265	21.5100	29.3238	(249)
Energy for lighting	456.9714	21.5100	98.2945	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.5185	21.5100	-105.2954	
PV Unit electricity exported	-188.2337	5.5900	-10.5223	
Total			-115.8177	(252)
Total energy cost			829.6010	(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	2270.2450	0.1564	355.1771	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1531.7091	0.1410	216.0152	(264)
Space and water heating			571.1923	(265)
Pumps, fans and electric keep-hot	136.3265	0.1387	18.9102	(267)
Energy for lighting	456.9714	0.1443	65.9551	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-489.5185	0.1327	-64.9733	
PV Unit electricity exported	-188.2337	0.1221	-22.9741	
Total			-87.9474	(269)
Total CO2, kg/year			568.1101	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2270.2450	1.5792	3585.0816 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1531.7091	1.5215	2330.4646 (278)
Space and water heating			5915.5462 (279)
Pumps, fans and electric keep-hot	136.3265	1.5128	206.2347 (281)
Energy for lighting	456.9714	1.5338	700.9180 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.5185	1.4904	-729.5920
PV Unit electricity exported	-188.2337	0.4477	-84.2781
Total			-813.8702 (283)
Total Primary energy kWh/year			6008.8288 (286)

SAP 10 EPC IMPROVEMENTS

House

Current energy efficiency rating: B 87
Current environmental impact rating: A 97

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 + 0.9 -£ 71 -42 kg (7.3%)

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

Potential energy efficiency rating: B 87
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 533 TEST (30 Nov 2023)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current £945	Potential £945	Saving £0
Electricity			
Space heating	£518	£518	£0
Water heating	£329	£329	£0
Lighting	£98	£98	£0
Generated (PV)	-£116	-£116	£0
Total cost of fuels	£829	£829	£0
Total cost of uses	£829	£829	£0
Delivered energy	14 kWh/m²	14 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.6 tonnes	0.6 tonnes	0.0 tonnes
CO2 emissions per m²	2 kg/m²	2 kg/m²	0 kg/m²
Primary energy	23 kWh/m²	23 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

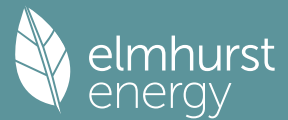
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (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)

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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)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
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	
Windows (Uw = 1.30)			47.3300	1.2357	58.4876			(27)
Doors			1.9100	1.4000	2.6740			(26a)
Heatloss Floor 1			134.5800	0.1200	16.1496			(28a)
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928			(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327			(30)
Total net area of external elements Aum(A, m2)			498.7500					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 134.4367			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.5000	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	33.5500	0.0300	1.0065	
E3 Sill	32.6400	0.0310	1.0118	
E4 Jamb	84.4000	0.0360	3.0384	
E5 Ground floor (normal)	49.6800	0.0590	2.9311	
E6 Intermediate floor within a dwelling	45.7800	0.0060	0.2747	
E16 Corner (normal)	19.8000	0.0520	1.0296	
E10 Eaves (insulation at ceiling level)	45.7800	0.0890	4.0744	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.3666	(36)
Point Thermal bridges			0.0000	(36a)
Total fabric heat loss			(33) + (36) + (36a) = 147.8033	(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	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	(38)
Heat transfer coeff	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	(39)
Average = Sum(39)m / 12 =												254.9571	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	(40)
HLP (average)												0.9726	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

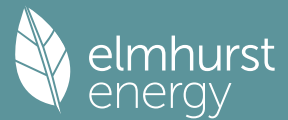
Assumed occupancy 3.0827 (42)

Hot water usage for mixer showers

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	97.5460	96.0800	93.9439	89.8568	86.8406	83.4769	81.5651	83.6850	86.0089	89.6204	93.7953	97.1722	(42a)
Hot water usage for baths	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses	46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002	(42c)
Average daily hot water use (litres/day)												131.9343	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724	(44)
Energy conte	227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865	(45)
Energy content (annual)										Total = Sum(45)m =		2191.6039	
Distribution loss (46)m = 0.15 x (45)m													
34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730	(46)	
Water storage loss:													
Store volume												250.0000	(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	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
Electric shower(s)												2729.6139	(64)
Total per year (kWh/year) = Sum(64)m =													

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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	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month	112.2517	99.5884	106.4573	95.0117	93.0975	84.9598	84.5555	87.2629	87.5161	96.3213	100.8971	111.1970 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.6890	57.4562	46.7265	35.3750	26.4432	22.3245	24.1224	31.3552	42.0849	53.4364	62.3682	66.4869 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	637.0726	643.6834	627.0244	591.5592	546.7908	504.7149	476.6055	469.9947	486.6538	522.1189	566.8873	608.9633 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791 (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)												
	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090 (71)
Water heating gains (Table 5)												
	150.8760	148.1970	143.0878	131.9608	125.1310	117.9998	113.6499	117.2888	121.5501	129.4642	140.1348	149.4583 (72)
Total internal gains	970.8712	967.5702	935.0723	877.1286	816.5987	763.2727	732.6114	736.8723	768.5223	823.2531	887.6239	943.1421 (73)

6. Solar gains

[Jan]					Area	Solar flux		g	FF		Access		Gains	
					m2	Table 6a		Specific data	Specific data		factor		W	
						W/m2		or Table 6b	or Table 6c		Table 6d			
Northeast					14.0500	11.2829		0.7600	0.7000		0.7700		58.4445 (75)	
Southeast					3.5700	36.7938		0.7600	0.7000		0.7700		48.4271 (77)	
Southwest					22.0400	36.7938		0.7600	0.7000		0.7700		298.9727 (79)	
Northwest					7.6700	11.2829		0.7600	0.7000		0.7700		31.9053 (81)	
Solar gains	437.7495	775.6598	1141.0050	1547.3723	1855.1406	1895.3690	1805.0139	1567.2037	1280.4399	878.7622	529.7882	371.0859 (83)		
Total gains	1408.6207	1743.2300	2076.0773	2424.5009	2671.7393	2658.6417	2537.6253	2304.0760	2048.9622	1702.0152	1417.4121	1314.2280 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713
alpha	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514
util living area	0.9894	0.9764	0.9462	0.8728	0.7401	0.5716	0.4303	0.4883	0.7256	0.9227	0.9805	0.9917 (86)
Living	19.1529	19.4505	19.8827	20.3752	20.7460	20.9278	20.9807	20.9693	20.8243	20.3028	19.6108	19.0782
Non living	17.9223	18.3001	18.8434	19.4453	19.8698	20.0538	20.0966	20.0897	19.9630	19.3722	18.5069	17.8271
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.0551	19.4505	19.8827	20.3752	20.7460	20.9278	20.9807	20.9693	20.8243	20.3028	19.6108	19.3471 (87)
Th 2	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063 (88)
util rest of house	0.9873	0.9719	0.9359	0.8490	0.6953	0.5042	0.3477	0.4014	0.6629	0.9028	0.9760	0.9901 (89)
MIT 2	19.2356	18.3001	18.8434	19.4453	19.8698	20.0538	20.0966	20.0897	19.9630	19.3722	18.5069	18.2378 (90)
Living area fraction									fLA = Living area / (4) =			0.1478 (91)
MIT	19.3567	18.4701	18.9970	19.5827	19.9993	20.1829	20.2273	20.2197	20.0902	19.5097	18.6700	18.4017 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3567	18.4701	18.9970	19.5827	19.9993	20.1829	20.2273	20.2197	20.0902	19.5097	18.6700	18.4017 (93)

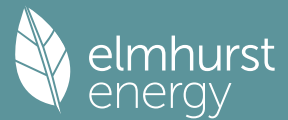
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9851	0.9606	0.9196	0.8328	0.6894	0.5102	0.3591	0.4129	0.6616	0.8862	0.9657	0.9857 (94)
Useful gains	1387.6997	1674.4853	1909.2491	2019.2215	1842.0064	1356.5052	911.3645	951.2574	1355.6448	1508.3860	1368.8229	1295.3815 (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	3838.8096	3459.7871	3186.2014	2723.6370	2115.9699	1423.4095	924.8003	973.8629	1527.2563	2271.5926	2949.8620	3620.8272 (97)
Space heating kWh	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98a)
Space heating requirement - total per year (kWh/year)												8120.7145
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	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												8120.7145
Space heating per m2										(98c) / (4) =		30.9774 (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 %)												312.0467 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1823.6258	1199.7228	950.0525	507.1792	203.8288	0.0000	0.0000	0.0000	0.0000	567.8257	1138.3481	1730.1316 (98)
Space heating efficiency (main heating system 1)												

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Space heating fuel (main heating system)	312.0467	312.0467	312.0467	312.0467	312.0467	0.0000	0.0000	0.0000	0.0000	312.0467	312.0467	312.0467	(210)
Space heating efficiency (main heating system 2)	584.4081	384.4690	304.4585	162.5331	65.3200	0.0000	0.0000	0.0000	0.0000	181.9682	364.8006	554.4464	(211)
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	(212)
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	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
Efficiency of water heater (217)m	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	(216)
Fuel for water heating, kWh/month	153.3905	135.5080	143.6116	125.4583	121.0648	108.4942	106.6489	111.2179	112.8082	126.5055	135.3907	151.6104	(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	11.5784	10.4579	11.5784	11.2049	11.5784	11.2049	11.5784	11.2049	11.5784	11.2049	11.5784	11.2049	(231)
Lighting	56.6219	45.4242	40.8995	29.9647	23.1456	18.9102	21.1142	27.4450	35.6484	46.7726	52.8295	58.1956	(232)
Electricity generated by PVs (Appendix M) (negative quantity)	-16.9042	-26.5686	-42.3532	-52.3564	-60.1654	-56.7132	-56.0069	-50.6195	-41.8806	-32.1090	-19.4326	-14.2782	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-2.1304	-5.0350	-11.0299	-18.5200	-26.7961	-28.5321	-28.2187	-23.3737	-16.5750	-8.1738	-3.1140	-1.6712	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												2602.4040	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.2071	
Water heating fuel used												1531.7091	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 7.7430, total flow = 45.0000, SFP = 0.1721)													
mechanical ventilation fans (SFP = 0.1721)												136.3265	(230a)
Total electricity for the above, kWh/year												136.3265	(231)
Electricity for lighting (calculated in Appendix L)												456.9714	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-642.5576	(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												4084.8533	(238)

10a. Fuel costs - using Table 12 prices													
						Fuel	Fuel price					Fuel cost	
						kWh/year	p/kWh					£/year	
Space heating - main system 1						2602.4040	16.4900					429.1364	(240)
Total CO2 associated with community systems												0.0000	(473)
Water heating (other fuel)						1531.7091	16.4900					252.5788	(247)
Energy for instantaneous electric shower(s)						0.0000	16.4900					0.0000	(247a)
Pumps, fans and electric keep-hot						136.3265	16.4900					22.4802	(249)
Energy for lighting						456.9714	16.4900					75.3546	(250)
Additional standing charges												0.0000	(251)
Energy saving/generation technologies													
PV Unit electricity used in dwelling						-469.3877	16.4900					-77.4020	
PV Unit electricity exported						-173.1699	5.5900					-9.6802	
Total												-87.0822	(252)
Total energy cost												692.4678	(255)

11a. SAP rating - Individual heating systems													
Energy cost deflator (Table 12):												0.3600	(256)
Energy cost factor (ECF)												0.8116	(257)
SAP value												86.8437	
SAP rating (Section 12)												87	(258)
SAP band												B	

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP													
						Energy	Emission factor					Emissions	
						kWh/year	kg CO2/kWh					kg CO2/year	
Space heating - main system 1						2602.4040	0.1558					405.4275	(261)
Total CO2 associated with community systems												0.0000	(373)
Water heating (other fuel)						1531.7091	0.1410					216.0152	(264)
Space and water heating												621.4427	(265)
Pumps, fans and electric keep-hot						136.3265	0.1387					18.9102	(267)
Energy for lighting						456.9714	0.1443					65.9551	(268)
Energy saving/generation technologies													
PV Unit electricity used in dwelling						-469.3877	0.1328					-62.3448	
PV Unit electricity exported						-173.1699	0.1224					-21.1957	
Total												-83.5405	(269)

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Total CO2, kg/year	622.7674 (272)
CO2 emissions per m2	2.3800 (273)
EI value	97.2831
EI rating	97 (274)
EI band	A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	134.5800 (1b)	x 2.5600 (2b)	= 344.5248 (1b) - (3b)
First floor	127.5700 (1c)	x 2.3900 (2c)	= 304.8923 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	262.1500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 649.4171 (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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) = 0.0000 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.2000 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1850 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1943	0.1850	0.1850	0.1711	0.1711	0.1526	0.1573	0.1480	0.1526	0.1619	0.1619	0.1758 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation												0.5000 (23b)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
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
Windows (Uw = 1.30)			47.3300	1.2357	58.4876		(27)
Doors			1.9100	1.4000	2.6740		(26a)
Heatloss Floor 1			134.5800	0.1200	16.1496		(28a)
External Wall 1	236.6000	49.2400	187.3600	0.2300	43.0928		(29a)
External Roof 1	127.5700		127.5700	0.1100	14.0327		(30)
Total net area of external elements Aum(A, m2)			498.7500				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 134.4367		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 144.5000 (35)

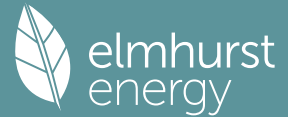
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	33.5500	0.0300	1.0065
E3 Sill	32.6400	0.0310	1.0118
E4 Jamb	84.4000	0.0360	3.0384
E5 Ground floor (normal)	49.6800	0.0590	2.9311
E6 Intermediate floor within a dwelling	45.7800	0.0060	0.2747
E16 Corner (normal)	19.8000	0.0520	1.0296
E10 Eaves (insulation at ceiling level)	45.7800	0.0890	4.0744
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			13.3666 (36)
Point Thermal bridges			0.0000 (36a)
Total fabric heat loss			(33) + (36) + (36a) = 147.8033 (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	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538	107.1538 (38)
Heat transfer coeff	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571	254.9571 (39)
Average = Sum(39)m / 12 =												254.9571
HLP	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726	0.9726 (40)
HLP (average)												0.9726
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												3.0827 (42)
Hot water usage for mixer showers												
97.5460	96.0800	93.9439	89.8568	86.8406	83.4769	81.5651	83.6850	86.0089	89.6204	93.7953	97.1722	(42a)
Hot water usage for baths												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(42b)
Hot water usage for other uses												
46.2002	44.5202	42.8402	41.1602	39.4802	37.8002	37.8002	39.4802	41.1602	42.8402	44.5202	46.2002	(42c)
Average daily hot water use (litres/day)												131.9343 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												
143.7461	140.6002	136.7841	131.0169	126.3207	121.2771	119.3652	123.1652	127.1691	132.4606	138.3155	143.3724	(44)
Energy content (annual)												
227.6587	200.2128	210.2320	179.3556	170.0520	149.1243	144.3619	152.5042	156.8122	179.7478	197.0558	224.4865	(45)
Distribution loss (46)m = 0.15 x (45)m												
34.1488	30.0319	31.5348	26.9033	25.5078	22.3687	21.6543	22.8756	23.5218	26.9622	29.5584	33.6730	(46)
Water storage loss:												
Store volume												250.0000 (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												
273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(62)
WWHRS												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter												
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h												
273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month												
112.2517	99.5884	106.4573	95.0117	93.0975	84.9598	84.5555	87.2629	87.5161	96.3213	100.8971	111.1970	(65)

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

Metabolic gains (Table 5), Watts												
(66)m	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	184.9635	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
64.6890	57.4562	46.7265	35.3750	26.4432	22.3245	24.1224	31.3552	42.0849	53.4364	62.3682	66.4869	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
637.0726	643.6834	627.0244	591.5592	546.7908	504.7149	476.6055	469.9947	486.6538	522.1189	566.8873	608.9633	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	56.5791	(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)												
-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	-123.3090	(71)
Water heating gains (Table 5)												
150.8760	148.1970	143.0878	131.9608	125.1310	117.9998	113.6499	117.2888	121.5501	129.4642	140.1348	149.4583	(72)
Total internal gains												
970.8712	967.5702	935.0723	877.1286	816.5987	763.2727	732.6114	736.8723	768.5223	823.2531	887.6239	943.1421	(73)

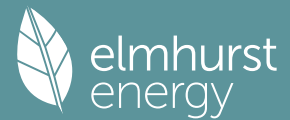
6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				14.0500	12.9236	0.7600	0.7000	0.7700	66.9427 (75)			
Southeast				3.5700	40.4699	0.7600	0.7000	0.7700	53.2654 (77)			
Southwest				22.0400	40.4699	0.7600	0.7000	0.7700	328.8431 (79)			
Northwest				7.6700	12.9236	0.7600	0.7000	0.7700	36.5445 (81)			
Solar gains	485.5958	776.0712	1133.0114	1592.4113	1866.5041	2043.1049	1923.7995	1703.8348	1381.3864	940.2430	602.4279	407.4689 (83)
Total gains	1456.4670	1743.6414	2068.0837	2469.5398	2683.1028	2806.3776	2656.4109	2440.7071	2149.9087	1763.4961	1490.0518	1350.6110 (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 from living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	41.2713	
alpha	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	3.7514	
util living area	0.9861	0.9730	0.9365	0.8397	0.6707	0.4411	0.2953	0.3306	0.6244	0.8911	0.9719	0.9891 (86)
Living	19.3119	19.5620	20.0128	20.5122	20.8451	20.9762	20.9962	20.9942	20.9120	20.4678	19.7965	19.2472
Non living	18.1253	18.4419	19.0065	19.6076	19.9742	20.0927	20.1052	20.1045	20.0448	19.5703	18.7422	18.0432
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	20.1364	19.5620	20.0128	20.5122	20.8451	20.9762	20.9962	20.9942	20.9120	20.4678	19.7965	19.4924 (87)
Th 2	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063	20.1063 (88)
util rest of house	0.9833	0.9676	0.9238	0.8097	0.6158	0.3672	0.2113	0.2400	0.5473	0.8626	0.9652	0.9869 (89)

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MIT 2	19.3165	18.4419	19.0065	19.6076	19.9742	20.0927	20.1052	20.1045	20.0448	19.5703	18.7422	18.4150 (90)
Living area fraction									FLA = Living area / (4) =			0.1478 (91)
MIT	19.4377	18.6074	19.1552	19.7413	20.1029	20.2233	20.2368	20.2360	20.1730	19.7030	18.8980	18.5742 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4377	18.6074	19.1552	19.7413	20.1029	20.2233	20.2368	20.2360	20.1730	19.7030	18.8980	18.5742 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9807	0.9554	0.9070	0.7958	0.6156	0.3771	0.2236	0.2533	0.5534	0.8471	0.9528	0.9815	(94)
Useful gains	1428.3568	1665.8346	1875.7051	1965.1701	1651.6339	1058.3069	594.0989	618.3359	1189.7948	1493.7917	1419.6845	1325.6183	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	3655.4967	3316.3246	2997.0692	2509.0969	1810.9390	1076.7494	595.7962	621.0680	1267.8938	2065.9101	2778.5295	3435.3394	(97)
Space heating kWh	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325	(98a)
Space heating requirement - total per year (kWh/year)												7084.2236	
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	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7084.2236	
Space heating per m2										(98c) / (4) =		27.0235	(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 %)													312.0467 (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	1656.9920	1109.1293	834.2949	391.6274	118.5230	0.0000	0.0000	0.0000	0.0000	425.6561	978.3684	1569.6325	(98)
Space heating efficiency (main heating system 1)	312.0467	312.0467	312.0467	312.0467	312.0467	0.0000	0.0000	0.0000	0.0000	312.0467	312.0467	312.0467	(210)
Space heating fuel (main heating system)	531.0078	355.4370	267.3622	125.5028	37.9825	0.0000	0.0000	0.0000	0.0000	136.4078	313.5327	503.0121	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	273.3527	241.4848	255.9260	223.5756	215.7460	193.3443	190.0559	198.1982	201.0322	225.4418	241.2758	270.1805	(64)
Efficiency of water heater	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	178.2071	(216)
Fuel for water heating, kWh/month	153.3905	135.5080	143.6116	125.4583	121.0648	108.4942	106.6489	111.2179	112.8082	126.5055	135.3907	151.6104	(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	11.5784	10.4579	11.5784	11.2049	11.5784	11.2049	11.5784	11.5784	11.2049	11.5784	11.2049	11.5784	(231)
Lighting	56.6219	45.4242	40.8995	29.9647	23.1456	18.9102	21.1142	27.4450	35.6484	46.7726	52.8295	58.1956	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-18.7437	-26.7013	-42.0447	-53.1851	-59.7953	-59.9657	-58.7062	-54.0331	-44.6623	-34.0255	-21.9603	-15.6953	(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	-2.5698	-5.1655	-11.1729	-19.6923	-27.3869	-31.5314	-30.7019	-26.2335	-18.5251	-9.3576	-3.9095	-1.9872	(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												2270.2450	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												178.2071	
Water heating fuel used												1531.7091	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 7.7430, total flow = 45.0000, SFP = 0.1721)													
mechanical ventilation fans (SFP = 0.1721)													136.3265 (230a)
Total electricity for the above, kWh/year													136.3265 (231)
Electricity for lighting (calculated in Appendix L)													456.9714 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation													-677.7522 (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													3717.4997 (238)

10a. Fuel costs - using BEDF prices (533)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
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Space heating - main system 1	2270.2450	21.5100	488.3297 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1531.7091	21.5100	329.4706 (247)
Energy for instantaneous electric shower(s)	0.0000	21.5100	0.0000 (247a)
Pumps, fans and electric keep-hot	136.3265	21.5100	29.3238 (249)
Energy for lighting	456.9714	21.5100	98.2945 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.5185	21.5100	-105.2954
PV Unit electricity exported	-188.2337	5.5900	-10.5223
Total			-115.8177 (252)
Total energy cost			829.6010 (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	2270.2450	0.1564	355.1771 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1531.7091	0.1410	216.0152 (264)
Space and water heating			571.1923 (265)
Pumps, fans and electric keep-hot	136.3265	0.1387	18.9102 (267)
Energy for lighting	456.9714	0.1443	65.9551 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.5185	0.1327	-64.9733
PV Unit electricity exported	-188.2337	0.1221	-22.9741
Total			-87.9474 (269)
Total CO2, kg/year			568.1101 (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	2270.2450	1.5792	3585.0816 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1531.7091	1.5215	2330.4646 (278)
Space and water heating			5915.5462 (279)
Pumps, fans and electric keep-hot	136.3265	1.5128	206.2347 (281)
Energy for lighting	456.9714	1.5338	700.9180 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-489.5185	1.4904	-729.5920
PV Unit electricity exported	-188.2337	0.4477	-84.2781
Total			-813.8702 (283)
Total Primary energy kWh/year			6008.8288 (286)