



Energy Report

Hogshaw Farm, Buxton

Client: Barratt Homes Manchester

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 - *Part F (ventilation)*
 - *Part G (water)*
- *BREEAM*
- *SBEM (existing and new build)*
- *Minimum Energy Efficiency Standards (MEES)*
- *Thermal Bridging (Psi value calculations)*

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1. Executive Summary

- 1.1.1. Barratt Homes Manchester has proposed a development with the first phase comprising of 116 dwellings which consist of detached, semi-detached, and terraced houses.
- 1.1.2. This application should refer to Policy EQ 1 of The High Peak Local Plan 2016, and Approved Document L 2021 regulations.
- 1.1.3. The proposed development of 116 dwellings at Hogshaw Farm, Buxton is designed to achieve reduced energy consumption through the adoption of good fabric performance and the use of Photovoltaic Panels, Waste Water Heat Recovery (WWHRS), Flu Gas Heat Recovery (FGHRS), and decentralised Mechanical Extract Ventilation (dMEV) to supply space heating and domestic hot water by consuming as little energy as possible.
- 1.1.4. Policy EQ 1 requires energy reduction solutions to reflect the approach found in the energy hierarchy:
- *Reduce the need for energy;*
 - *To use energy more efficiently;*
 - *To use renewable energy;*
 - *Any continuing use of fossil fuels to be clean and efficient for heating and co-generation.*
- The following energy report shows how the energy hierarchy has been implemented at Hogshaw Farm.
- 1.1.5. 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.
- 1.1.6. 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.
- 1.1.7. The proposed development complies with the relevant policies as set out in The High Peak Local Plan 2016.

2. Introduction

2.1. Description of Site

- 2.1.1. In brief, the proposed development currently consists of 116 dwellings.
- 2.1.2. The location and proposed site plans are shown in Appendix A.
- 2.1.3. The site will consist of detached, semi-detached, and terraced housing.

3. Planning Policy

- 3.1.1. Policies relating to this development are contained within the The High Peak Local Plan 2016.

3.2. Planning Policy – The High Peak Local Plan 2016

- 3.2.1. Residential development within the proposed site is required to address energy efficiency and carbon emissions by consideration of Policy EQ 1. It is as follows:

"Climate Change

The Council will adopt strategies to mitigate and adapt to climate change. In addressing the move to a low carbon future for High Peak, the Council will plan for new development in locations and ways that reduce greenhouse gas emissions and adopt the principles set out in the energy hierarchy.

The Council intends to meet part of its future energy needs through renewable or low carbon energy sources and will therefore encourage and support the provision of renewable and low carbon technologies, including both stand-alone installations, and micro-renewables integrated within new or existing development.

A low carbon future for High Peak will be achieved by:

- *Requiring new development to be designed to contribute to achieving national targets to reduce greenhouse gas emissions by using land-form, layout, building orientation, tree planting, massing and landscaping to reduce likely energy consumption and resilience to increased temperatures;*
- *Ensuring that renewable energy installations do not have an adverse impact on the integrity of any European sites, (including by project- level HRA where appropriate), wildlife sites, protected species or habitats, or the landscape and landscape setting of the Peak District National Park;*
- *Supporting opportunities to deliver decentralised energy systems, particularly those which are powered by a renewable or low carbon source;*

- *Supporting connection to an existing decentralised energy supply system where there is capacity to supply the proposed development, or design for a future connection where there a firm proposals for such a system;*
- *Ensuring that renewable / low carbon energy generation developments and associated infrastructure are supported by requiring Design Statements to include an assessment of how any impacts on the environment and heritage assets, including cumulative landscape, noise and visual impacts, can be avoided and/or mitigated through careful consideration of location, scale, design and other measures;*
- *Applications for new build residential development in the Buxton Sub-Area should meet the optional national technical requirement for water efficiency of 110 litres per person per day to minimise the phosphate load to the River Wye via discharges from the Buxton Sewage Treatment Works, unless it can be demonstrated that doing so would adversely impact on a scheme's viability;*
- *Promoting energy efficiency and the use of renewable / low carbon energy in new development and through retro-fitting of existing buildings;*
- *Supporting sustainable waste management by provision of space for recycling and composting;*
- *Supporting the use of sustainable design and construction techniques including the use of recycled materials in construction, including where appropriate the local or on-site sourcing of these building materials;*
- *Supporting high water efficiency standards and measures to recycle and minimise water consumption."*

3.2.2. The energy hierarchy referenced in Policy EQ 1 is as follows:

- *Reduce the need for energy;*
- *To use energy more efficiently;*
- *To use renewable energy;*
- *Any continuing use of fossil fuels to be clean and efficient for heating and co-generation.*

This energy report will seek to reflect the approach of the energy hierarchy.

3.2.3. The High Peak Borough Council has declared the High Peak Local Plan 2016 as partially out-of-date. A creation of a new local plan is scheduled, and details of the plan have not yet been released.

3.2.4. However, the council has released an 'Early Engagement' document that reviews what the implicated changes are to the local plan. Domestic developments will be expected to follow more "aspirational and specific" policies in future versions of the local plan.

3.2.5. As a result, if the proposed development were to be submitted again at a later date, the development may have to adhere to higher standard policies.

3.3. Building regulations

- 3.3.1. The 116 dwellings for this development fall under Part L1A 2021 of the building regulations, and therefore will be required to follow SAP 10 methodology. As discussed, 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%.
- 3.3.2. 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. For reference, see the tables in Appendix B for the SAP 2012 and SAP 10 carbon factors.

4. Design Response

4.1. Assessment Methodology

4.1.1. Environmental Economics have modelled the proposed dwellings using the software Design SAP 10 by Elmhurst and approved by BRE. The software provides several outputs, and based of the provided specification for this proposed development, we can 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)*

4.1.2. 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 are based upon:

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

4.1.3. 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 now been fully approved as shown in Appendix C. The software available to assessors should no longer need revisions due to any bugs which create uncertainty in the results.

4.1.4. The draft SAP reports used in this energy report are shown in Appendix F.

4.2. Design Philosophy

- 4.2.1. In order to improve the dwelling performance to achieve ADL 2021, various upgrades have been made to almost all physical elements of a typical ADL 2013 specification.
- 4.2.2. The proposed development adopts the good design principles endorsed and promoted by The Zero Carbon Hub, the construction industries' key advisors and partners with the Governments Department for Levelling Up, Housing and Communities. This guidance follows the general good principles of energy efficiency as the industry moves towards zero carbon. The principles are illustrated in figure 1

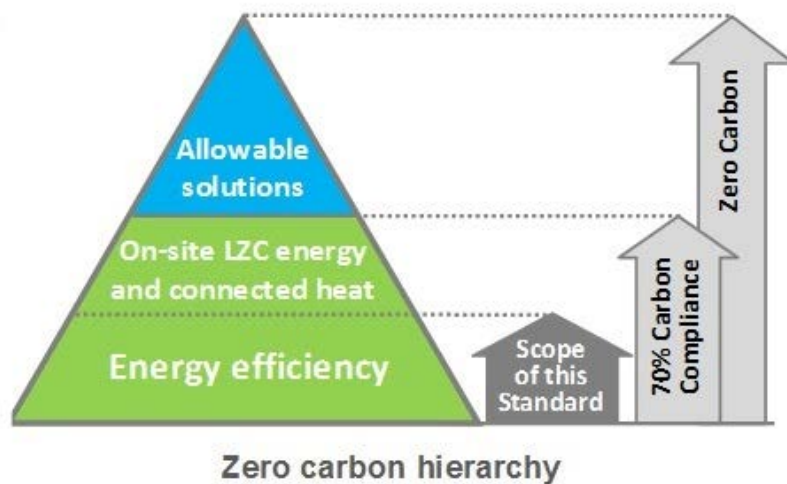


Figure 1

below.

- 4.2.3. 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 $4\text{m}^3/\text{hr}/\text{m}^2$*
 - *Bespoke, low heat loss thermal bridging designs*

4.3. Building Fabric

4.3.1. The building fabric for all dwellings within 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.

4.3.2. The draft standard U-Values of external elements are shown in table 2 below.

<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	Brick, 100mm Cavity with 95mm Alreflex Platinum, 100mm Block (K-value 0.11), P/B on Dabs	0.24
Roof	0.16	Horizontal Ceiling; 500mm Mineral Wool (K-Value 0.044)	0.09
		Sloping Ceiling; insulated to achieve	0.14
Floors	0.18	225mm Thermal Economics Platinum Ground Floor Insulation; Beam and Block build	0.10-0.11
Doors	1.60	Front Door	1.20
Glazing	1.60	uPVC double glazed; G-Value 0.73	1.20

Table 2 – Design U Values

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

4.3.4. We have assumed Notional psi values from Table R2 of Appendix R in 'The Government's Standard Assessment Procedure for Energy Rating of Dwellings' wherever necessary. During the detailed design stage of development, it should be ensured that these performance levels are realised.

4.3.5. As a result of following these junction details and focusing on build quality air permeability will also decrease. A target air pressure rating of 4.0m³/hr.m² has been set for all houses on site which is a 37.5% improvement on the maximum allowable rating in the 2021 Building Regulations.

4.4. Building Services & Renewable Energy (LZCT)

- 4.4.1. 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. ADL 2021 includes requirements for efficiency and controls of such equipment, including space heating, water heating, ventilation, and lighting.
- 4.4.2. The design of building services which provide space heating and domestic hot water, ventilation, and lighting, must be considered in a holistic way to avoid unintended consequences and to maximise the benefits from such systems.
- 4.4.3. After due consideration of the potential LZCT available (shown in Appendix C) the design team propose to adopt the following technologies which provide benefits / compliance with national and local policies as listed:
- **Photovoltaic (PV) panels**
 - Low noise and visual pollution;
 - Efficient low-carbon source of renewable energy;
 - **Decentralised Mechanical Extract Ventilation (dMEV)**
 - Quieter than standard extractor fans;
 - Technology that manages humidity that is significantly more energy efficient in comparison to standard extractor fans.
 - **Waste Water Heat Recovery (WWHR)**
 - Passive technology, no maintenance required;
 - Recovers waste heat from shower, pre-heats incoming cold. This reduces the amount of hot water required from the hot water cylinder;
 - Typical systems recover ~60% waste heat.
 - **Flue Gas Heat Recovery (FGHR)**
 - Recovers waste heat from the flue of a boiler;
 - Reduces energy demand by reducing the temperature increase required for the boiler to operate;
- 4.4.4. It is currently proposed that PV panels will be used to improve dwelling performance to the level required for Part L 2021. The amount of PV which will be required for this development is to be calculated at the detailed design stage.
- 4.4.5. For 2021 regulations, it is currently proposed to provide heating and hot water via main gas boilers.
- 4.4.6. For a mains gas fired system, the minimum boiler efficiency required is 92%. Compliant Ideal Logic boilers have been adopted which exceed this requirement.

- 4.4.7. 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.
- 4.4.8. 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 Part L 2013 performance levels.
- 4.4.9. 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

4.5. Energy Hierarchy

- 4.5.1. Policy EQ 1 requires developments to approach energy reduction using the energy hierarchy found in the High Peak Local Plan.

1. *Reduce the need for energy:*

Chapter 4.3 displays solutions for fabric efficiency. The recommended uplifts listed in this chapter will help reduce heat-loss and help insulate households. Thus, reducing the required increase in energy to heat a space.

2. *To use energy more efficiently:*

Chapter 4.4 lists multiple building services that will be incorporated into the dwellings at Hogshaw Farm. Amongst them include Waste Water and Flue Gas Heat Recovery Systems. This will recover any lost heat from the dwellings, and supply the heat back into their respective systems. This allows all energy generated to heat water and space to be used more efficiently.

3. *To use renewable energy:*

In chapter 4.4, we have recommended the use of Photovoltaic panels to produce renewable energy efficiently for the dwellings at Hogshaw Farm.

4. *Any continuing use of fossil fuels to be clean and efficient for heating and co-generation.*

- 4.5.2. Thus, this energy report has achieved a solution to reducing energy consumption using the energy hierarchy in the High Peak Local Plan.

4.6. Water Use

- 4.6.1. The criteria for measuring potable water usage are set out in Approved Document G of the Building Regulations.
- 4.6.2. All dwellings on site can be designed to achieve the maximum of 105 litres per person per day internal potable water, with an additional allowance for external water use of 5 litres per person per day. The total internal water consumption estimate is 101.6 litres per person per day for dwellings with a bath and shower; and 90.6 litres per person per day for any dwellings with only a shower. An additional 5L is specified for external use. The specification of water fittings will be identified at the detailed design stage.
- 4.6.3. Representative data has been input into the BRE's Water Efficiency Calculator for New Dwellings for relevant domestic water consuming components; dual flush WC, taps and kitchen sink taps, bath and shower. Washing machine and dishwasher specification have been set to default rates as standard practice.
- 4.6.4. The following representative rates have been utilised:
- *Dual Flush WC – 4L & 2.6L flush volumes;*
 - *Taps – 4L per minute flow rate;*
 - *Bath – 195L overflow capacity;*
 - *Shower – 8L per minute flow rate;*
 - *Kitchen sink taps – 4L per minute flow rate.*
- 4.6.5. Alternative component consumption rates are available which can achieve the required water consumption. The rates provided are representative only.
- 4.6.6. The calculator can be found in Appendix E.
- 4.6.7. The calculated results show that utilisation of the representative component's water consumption can achieve a maximum of 105 litres per person per day internally, and additional external water use of 5 litres per person per day.
- 4.6.8. The development therefore exceeds the requirements set out in policy EQ 1 of the High Peak Local Plan.

5. Results (Energy & Carbon)

5.1.1. Detailed information of the SAP calculations from the SAP 10 Software can be found in Appendix F.

5.1.2. The tables below shows a sample of the SAP calculations.

AD-L 2021 metrics	3 Bedroom Terrace	4 Bedroom Detached
SAP 10 Rating	90 B	95 A
CO2 emissions	0.74 t/yr	1.07 t/yr
TER kgCO ₂ /yr/m ²	11.97	10.13
DER kgCO ₂ /yr/m ²	11.06	10.00
Pass by %	7.60%	1.28%

Table 3a – Carbon Emissions

5.1.3. Table 3a refers to the primary metric from Part L 2021, DER (Carbon emissions). It can be seen that the results are excellent, with very low Carbon emissions at around 10-11 kgCO₂/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).

AD-L 2021 metrics	3 Bedroom Terrace	4 Bedroom Detached
TPER kWh/m ² /yr	62.55	52.96
DPER kWh/m ² /yr	59.06	52.29
Pass by %	5.58%	1.27%
TFEE kWh/m ² /yr	36.50	42.05
DFEE kWh/m ² /yr	35.39	41.92
Pass by %	3.03%	0.31%

Table 3b – Primary Energy Rate and Fabric Energy Efficiency

5.1.4. Table 3b shows the Primary Energy Rate (PER) for the sample house types, as well as the fabric energy efficiency (FEE). 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.

5.1.5. The SAP 10 results show that all the sample house types pass both metrics required for Part L 2021 regulations. This is impressive due to the high standards set out by the new Part L1A 2021, and is a significant improvement compared to the typical results found in Part L1A 2013.

5.1.6. All dwelling house designs pass over and above Part L1A 2021 regulations.

6. Conclusion

- 6.1.1. This Energy Report has been produced to accompany the planning application for the proposed development of 116 dwellings at Hogshaw Farm, Buxton.
- 6.1.2. Energy consumption shall be decreased through the combined adoption of good fabric performance, as well as the implementation of the LZC Technologies discussed in chapter 4 to supply heat and hot water that allow a reduction in the consumption of energy.
- 6.1.3. The energy hierarchy in the High Peak Local Plan 2016 has been implemented to find energy reduction solutions.
- 6.1.4. 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.
- 6.1.5. The results from the calculated SAPs, presented in appendix F, show the proposed dwellings passing over and above the Part L 2021 regulations. Ironbridge also performs significantly better compared to the regulations set out in Part L1A 2013.
- 6.1.6. Hogshaw Farm, Buxton also complies with Policy EQ 1 of The High Peak Local Plan 2016.

[illegible]

Appendix B – Carbon Factors

Table A

SAP 2012 version 9.92 (October 2013)

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ ^(a)	Unit price p/kWh	Emissions kg CO ₂ per kWh ^(b)	Primary energy factor	Fuel code
Gas:					
mains gas	120	3.48	0.216	1.22	1
bulk LPG	70	7.60	0.241	1.09	2
bottled LPG		9.87	0.242	1.07	3
LPG subject to Special Condition 18 ^(c)	120	3.37	0.242	1.07	9
biogas (including anaerobic digestion)	70	7.60	0.098	1.10	7
Oil:					
heating oil		5.44	0.298	1.10	4
biodiesel from any biomass source ^(d)		7.64	0.123	1.06	71
biodiesel from vegetable oil only ^(e)		7.64	0.083	1.01	73
appliances able to use mineral oil or biodiesel		5.44	0.298	1.10	74
B30K ^(f)		6.10	0.245	1.09	75
bioethanol from any biomass source		47.0	0.140	1.08	76
Solid fuel: ^(g)					
house coal		3.67	0.394	1.00	11
anthracite		3.64	0.394	1.01	15
manufactured smokeless fuel		4.61	0.433	1.21	12
wood logs		4.23	0.019	1.04	20
wood pellets (in bags for secondary heating)		5.81	0.039	1.26	22
wood pellets (bulk supply for main heating)		5.26	0.039	1.26	23
wood chips		3.07	0.016	1.12	21
dual fuel appliance (mineral and wood)		3.99	0.226	1.02	10
Electricity:					
standard tariff ^(a)	54	13.19	0.519	3.07	30
7-hour tariff (high rate) ^(b)	24	15.29	0.519	3.07	32
7-hour tariff (low rate) ^(b)		5.50	0.519	3.07	31
10-hour tariff (high rate) ^(b)	23	14.68	0.519	3.07	34
10-hour tariff (low rate) ^(b)		7.50	0.519	3.07	33
18-hour tariff (high rate) ^(b)	40	13.67	0.519	3.07	38
18-hour tariff (low rate) ^(b)		7.41	0.519	3.07	40
24-hour heating tariff	70	6.61	0.519	3.07	35
electricity sold to grid		13.19 ⁽ⁱ⁾	0.519	3.07	36
electricity displaced from grid			0.519 ⁽ⁱ⁾	3.07 ⁽ⁱ⁾	37
electricity, any tariff ⁽ⁱ⁾					39
Community heating schemes: ^(k)	120 ^(l)				
heat from boilers – mains gas		4.24	0.216	1.22	51
heat from boilers – LPG		4.24	0.241	1.09	52
heat from boilers – oil		4.24	0.331 ^(m)	1.10	53
heat from boilers that can use mineral oil or biodiesel		4.24	0.331	1.10	56
heat from boilers using biodiesel from any biomass source		4.24	0.123	1.06	57
heat from boilers using biodiesel from vegetable oil only		4.24	0.083	1.01	58
heat from boilers – B30D ^(l)		4.24	0.269	1.09	55
heat from boilers – coal		4.24	0.380 ⁽ⁿ⁾	1.00	54
heat from electric heat pump		4.24	0.519	3.07	41
heat from boilers – waste combustion		4.24	0.047	1.23	42
heat from boilers – biomass		4.24	0.031 ^(o)	1.01	43
heat from boilers – biogas (landfill or sewage gas)		4.24	0.098	1.10	44
waste heat from power station		2.97	0.058 ^(p)	1.34	45
geothermal heat source		2.97	0.041	1.24	46
heat from CHP		2.97	as above ^(q)	as above ^(q)	48
electricity generated by CHP			0.519 ⁽ⁱ⁾	3.07 ⁽ⁱ⁾	49
electricity for pumping in distribution network			0.519	3.07	50

Energy Cost Deflator^(r) = 0.42

Table B

SAP version 10.2 (20-08-2021)

Table 12: Fuel prices, emission factors and primary energy factors

Fuel	Standing charge, £ ^(a)	Unit price p/kWh	Emissions kg CO _{2e} per kWh ^{(b) (s)}	Primary energy factor ^(t)	Fuel code
Gas fuels:					
mains gas	92	3.64	0.210	1.130	1
bulk LPG	62	6.74	0.241	1.141	2
bottled LPG (for main heating system)		9.46	0.241	1.141	3
bottled LPG (for secondary heating)		11.20	0.241	1.133	5
LPG subject to Special Condition 11F ^(c)	92	3.64	0.241	1.163	9
biogas (including anaerobic digestion)	62	6.74	0.024	1.286	7
Liquid fuels:					
heating oil		4.94	0.298	1.180	4
bio-liquid HVO from used cooking oil ^(d)		6.79	0.036	1.180	71
bio-liquid FAME from animal/vegetable oils ^(e)		6.79	0.018	1.180	73
B30K ^(f)		5.49	0.214	1.136	75
bioethanol from any biomass source		47	0.105	1.472	76
Solid fuels: ^(g)					
house coal		5.58	0.395	1.064	11
anthracite		4.19	0.395	1.064	15
manufactured smokeless fuel		5.91	0.366	1.261	12
wood logs		5.12	0.028	1.046	20
wood pellets (in bags for secondary heating)		6.91	0.053	1.325	22
wood pellets (bulk supply for main heating)		6.25	0.053	1.325	23
wood chips		3.72	0.023	1.046	21
dual fuel appliance (mineral and wood)		4.77	0.087	1.049	10
Electricity: ^(a)					
standard tariff	81	16.49	0.136	1.501	30
7-hour tariff (high rate) ^(h)	7	19.60	0.136	1.501	32
7-hour tariff (low rate) ^(h)		9.40	0.136	1.501	31
10-hour tariff (high rate) ^(h)	21	20.54	0.136	1.501	34
10-hour tariff (low rate) ^(h)		12.27	0.136	1.501	33
18-hour tariff (high rate) ^(h)	26	17.41	0.136	1.501	38
18-hour tariff (low rate) ^(h)		14.17	0.136	1.501	40
24-hour heating tariff	26	14.04	0.136	1.501	35
electricity sold to grid, PV		5.59 ⁽ⁱ⁾	0.136	0.501	60
electricity sold to grid, other		5.59 ⁽ⁱ⁾	0.136	0.501	36
electricity, any tariff ⁽ⁱ⁾		N/A	0.136	1.501	39
Heat networks: ^(k)					
heat from boilers – mains gas	92 ^(l)	4.44	0.210	1.130	51
heat from boilers – LPG		4.44	0.241	1.141	52
heat from boilers – oil (assumes 'gas oil')		4.44	0.335	1.180	53
heat from boilers that can use mineral oil or biodiesel		4.44	0.335	1.180	56
heat from boilers using HVO from used cooking oil		4.44	0.036	1.180	57
heat from boilers FAME from animal/vegetable oils ^(e)		4.44	0.018	1.180	58
heat from boilers – B30D ^(f)		4.44	0.269	1.090	55
heat from boilers – coal		4.44	0.375	1.064	54
heat from electric heat pump		4.44	0.136	1.501	41
heat from boilers – waste combustion		4.44	Under review	Under review	42
heat from boilers – biomass		4.44	Under review	Under review	43
heat from boilers – biogas (landfill or sewage gas)		4.44	Under review	Under review	44
waste heat from power station		3.77	Under review	Under review	45
geothermal heat source		3.77	Under review	Under review	46
heat from CHP		3.77	as above ^(q)	as above ^(q)	48
electricity generated by CHP			Under review	Under review	49
electricity for pumping in distribution network			0.136	1.501	50
Fuel from PCDB ^(u)					
Data for each field comes from PCDB table					99
Energy Cost Deflator ^(v) = 0.36					

Appendix C – Software Approval (SAP 10)

Approved software for SAP 10.2*

Updated: 22nd November 2022

SAP 10.2 – applicable for building regulations from 15th June 2022 in England, and from 15th June 2022 for EPC lodgements in England.

List of SAP programs tested by BRE* for use in connection with building regulations and Energy Performance Certificates for new dwellings

Phased approval: The following software packages have been granted approval specific to dwellings with the following features:

Phase 1	Building fabric (walls, roofs, floors, windows etc.), Boilers (mains gas, LPG, electric, oil), FGHRs, Secondary room heaters, Instantaneous WWHRs, Solar heating (hot water only), Natural ventilation with intermittent extract fans, Centralised MEV, Decentralised MEV, Balanced ventilation with heat recovery (MVHR), PV (without battery or diverter), and Air conditioning.
Phase 2	All Phase 1, plus Electric heat pumps, Electric immersion, PV with battery, PV with diverter, and Wind turbines.
Phase 3	All Phase 2 plus Heat Networks (not from PCDB), Balanced ventilation without heat recovery.

Full Approval: The following software packages have been tested for full approval covering:

Phase 4	All Phase 3 plus all other systems including Storage WWHRs, Solar heating (space and water heating), and Heat Networks from PCDB
Phase 5	All Phase 4 plus production of EPCs including improvement recommendations, element star ratings and element descriptions

See also notes on last page.

* The SAP programs listed have been checked by BRE on behalf of BEIS, DLUHC, BSD and the Welsh Government. Whilst BRE has taken due care and precaution in testing the programs, it will not be held liable for any failure or consequence thereof that may occur in their use or application.

SAP 10.2 Page 1 of 3

Approved software for SAP 10.2*

Updated: 22nd November 2022

Organisation	Contact name	Address, telephone, e-mail, website	Calculation Software	Phase	Version	Building Regulations				EPC				Date of approval
			User Interface			E	W	S	NI	E	W	S	NI	
Stroma Certification Limited	The SAP Team	6 Silkwood Park, Fryers Way, Wakefield, WF5 9TJ 0345 621 1111 www.stroma.com/certification SAP@stroma.com	FSAP 10.2	1	1.x	Yes	-	-	-	-	-	-	-	08/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	04/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	17/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	28/07/2022
				5	1.x	Yes	Yes	-	-	Yes	Yes	-	-	31/10/2022
			FSAP 10.2 UI	1	1.x	Yes	-	-	-	-	-	-	-	14/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	06/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	1.x	Yes	-	-	-	Yes	-	-	-	19/08/2022
Elmhurst Energy Systems LTD	New Build Dwelling Support Team	16 St Johns Business Park Lutterworth Leicestershire LE17 4HB Tel: 01455 883250 www.elmhurstenergy.co.uk onconstruction-support@elmhurstenergy.co.uk	Design SAP 10	1	1.x	Yes	-	-	-	-	-	-	-	09/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	28/06/2022
				3	1.x	Yes	-	-	-	-	-	-	-	27/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	2.x	Yes	Yes	-	-	Yes	Yes	-	-	22/11/2022
			Design SAP 10	1	1.x	Yes	-	-	-	-	-	-	-	10/06/2022
				2	1.x	Yes	-	-	-	-	-	-	-	07/07/2022
				3	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				4	1.x	Yes	-	-	-	-	-	-	-	29/07/2022
				5	2.x	Yes	Yes	-	-	Yes	Yes	-	-	22/11/2022

* The SAP programs listed have been checked by BRE on behalf of BEIS, DLUHC, BSD and the Welsh Government. Whilst BRE has taken due care and precaution in testing the programs, it will not be held liable for any failure or consequence thereof that may occur in their use or application.

SAP 10.2 Page 2 of 3

Approved software for SAP 10.2*

Updated: 22nd November 2022

Organisation	Contact name	Address, telephone, e-mail, website	Calculation Software	Phase	Version	Building Regulations				EPC				Date of approval
			User Interface			E	W	S	NI	E	W	S	NI	
Argyle Software Ltd	SAP Registration Team	7-9 North Parade Buildings Bath Somerset BA1 1NS Telephone: 01225 667210 Email: sap@argylesoftware.co.uk Web: www.argylesoftware.co.uk	Argyle Software Ltd ACE	1	1.x	Yes	-	-	-	-	-	-	-	04/07/2022
				2	1.x	Yes	-	-	-	-	-	-	-	04/08/2022
				3	1.x	Yes	-	-	-	-	-	-	-	22/08/2022
				5	1.x	Yes	-	-	-	Yes	-	-	-	20/10/2022

NOTES

1. E: England; W: Wales; S: Scotland; NI: Northern Ireland. SAP 10.2 is not yet applicable in Wales, Scotland or Northern Ireland.
2. "Building Regulations" indicates whether the software calculates the target and dwelling emissions for building regulations. "EPC" indicates whether the software produces an energy performance certificate.
3. "x" in the version number may be incremented for minor updates that do not affect the calculated results. The software approval applies to any "x".
4. The list of programs is complete as at the date at the top of the page. Additional programs may be added.

For further information on SAP 10.2 see: <https://bregroup.com/sap/sap10/>

* The SAP programs listed have been checked by BRE on behalf of BEIS, DLUHC, BSD and the Welsh Government. Whilst BRE has taken due care and precaution in testing the programs, it will not be held liable for any failure or consequence thereof that may occur in their use or application.

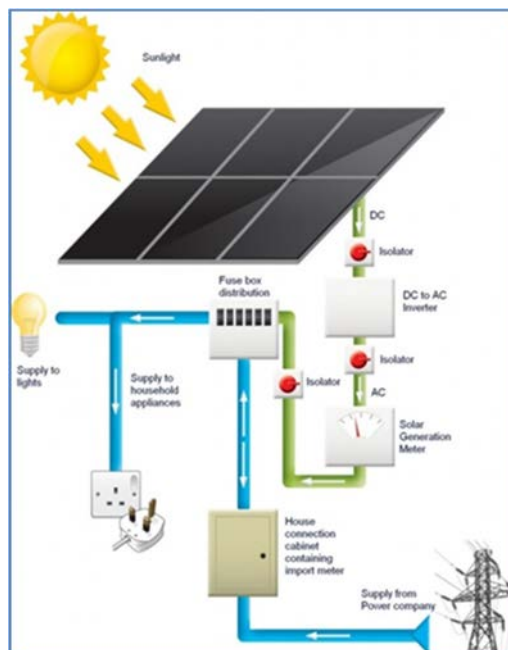
SAP 10.2 Page 3 of 3

Appendix D – LZC Technologies Comparison

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)

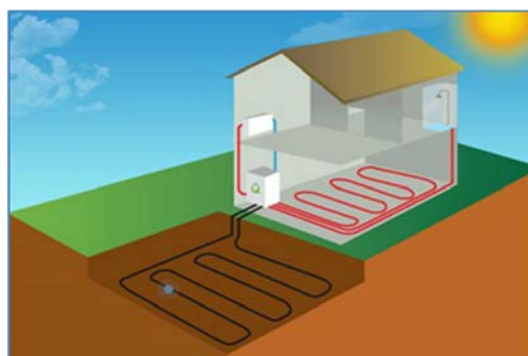
ASHP provide heating and hot water to a home through thermal energy gathered from air outside the dwelling. Systems can be designed to work in conjunction with a boiler system but in the case of energy efficient new builds it is possible for an ASHP unit to provide 100% of the heating and hot water demand.



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

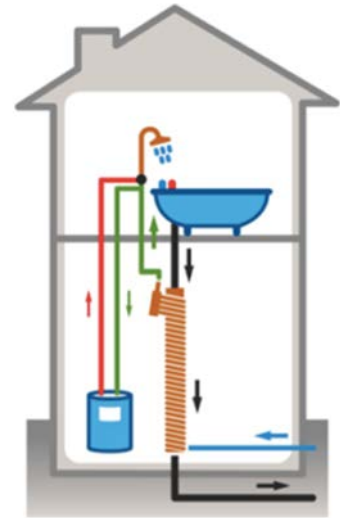
Wind turbines provide electricity directly to a dwelling. They can be added to a property in two ways: pole mounted or building mounted. The pole mounted systems are free standing and therefore require enough space around them to allow for the construction and maintenance of the structure, as well as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



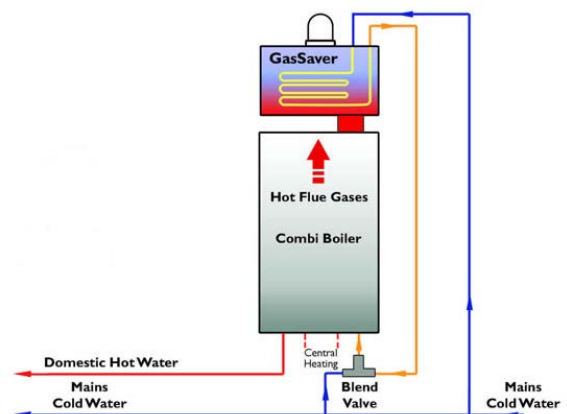
WWHRS

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.



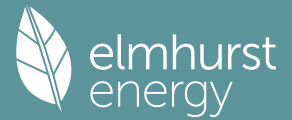
Appendix E – Water Efficiency Calculations

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS - (BASIC CALCULATOR)									
House Type:		Type 1		Type 2		Type 3		Type 4	
Description:		Bath and Shower		Shower only					
Installation Type	Unit of measure	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day	Capacity/ flow rate	Litres/ person/ day
Is a dual or single flush WC specified?		Dual		Dual		Select option:		Select option:	
WC	Full flush volume	4	5.84	4	5.84		0.00		0.00
	Part flush volume	2.6	7.70	2.5	7.40		0.00		0.00
Taps (excluding kitchen and external taps)	Flow rate (litres / minute)	4	7.90	4	7.90		0.00		0.00
Are both a Bath & Shower Present?		Bath & Shower		Shower only					
Bath	Capacity to overflow	195	21.45		0.00		0.00		0.00
Shower	Flow rate (litres / minute)	8	34.96	8	44.80		0.00		0.00
Kitchen sink taps	Flow rate (litres / minute)	4	12.12	4	12.12		0.00		0.00
Has a washing machine been specified?		No		Yes					
Washing Machine	Litres / kg		17.16	8.1	17.01		0.00		0.00
Has a dishwasher been specified?		No		No					
Dishwasher	Litres / place setting		4.50		4.50		0.00		0.00
Has a waste disposal unit been specified?		No		No			0.00		0.00
Water Softener	Litres / person / day		0.00		0.00		0.00		0.00
Calculated Use		111.6		99.6			0.0		0.0
Normalisation factor		0.91		0.91			0.91		0.91
Code for Sustainable Homes	Total Consumption	101.6		90.6			0.0		0.0
	Mandatory level	Level 3/4		Level 3/4			-		-
Building Regulations 17.K	External use	5.0		5.0			5.0		5.0
	Total Consumption	106.6		95.6			0.0		0.0
	17.K Compliance?	Yes		Yes			-		-

Appendix F - SAP Calculations

SAP Calculations can be found on the following pages

Full SAP Calculation Printout



Property Reference	3 Bedroom End 21 X			Issued on Date	30/01/2023
Assessment Reference	1	Prop Type Ref			
Property	Plot x, Maidstone, ME20				
SAP Rating	90 B	DER	11.06	TER	11.97
Environmental	91 B	% DER < TER			7.60
CO ₂ Emissions (t/year)	0.74	DFEE	35.39	TFEE	36.50
Compliance Check	See BREL	% DFEE < TFEE			3.03
% DPER < TPER	5.58	DPER	59.06	TPER	62.55
Assessor Details	Ms. Hazel Black			Assessor ID	M003-0001
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	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) -
First floor	38.0100 (1c)	x 2.5600 (2c)	= 97.3056 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.1087 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

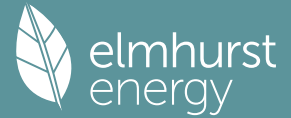
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour
Pressure test	0.0000 / (5) = 0.0000 (8)
Pressure Test Method	Yes
Measured/design AP50	Blower Door
Infiltration rate	4.0000 (17)
Number of sides sheltered	0.2000 (18)
	2 (19)
Shelter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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												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 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
Opening Type 1 (Uw = 1.20)			12.7200	1.1450	14.5649		(27)
Opening Type 3			2.3800	1.2000	2.8560		(26)
225mm TE Platinum BB			38.0100	0.1000	3.8010		(28a)

Full SAP Calculation Printout



100mm Ecobead Platinum	85.2400	15.1000	70.1400	0.2400	16.8336	(29a)
Roof 1	38.0100		38.0100	0.0900	3.4209	(30)
Total net area of external elements Aum(A, m2)			161.2600			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.4764	(33)
Wall 1			38.9800	0.0000	0.0000	(32)

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

150.2900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.2700	0.0320	0.1686
E2 Other lintels (including other steel lintels)	4.9400	0.0320	0.1581
E3 Sill	9.1900	0.0310	0.2849
E4 Jamb	17.6500	0.0360	0.6354
E5 Ground floor (normal)	17.5000	0.0590	1.0325
E6 Intermediate floor within a dwelling	17.5000	0.0060	0.1050
E10 Eaves (insulation at ceiling level)	9.5000	0.1030	0.9785
E10 Eaves (insulation at ceiling level)	8.0000	0.0780	0.6240
E16 Corner (normal)	9.7400	0.0520	0.5065
E18 Party wall between dwellings	9.7400	0.0530	0.5162
P1 Party wall - Ground floor	8.0000	0.0860	0.6880
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.0770	0.6160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			6.3137 (36)
Point Thermal bridges			0.0000
Total fabric heat loss		(33) + (36) + (36a) =	47.7901 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	30.5429	(38)
Heat transfer coeff	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	78.3330	(39)
Average = Sum(39)m / 12 =													(39)
HLP	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	1.0304	(40)
HLP (average)													(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(40)

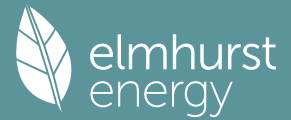
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.3830 (42)
Hot water usage for mixer showers	88.2405	86.9144	84.9821	81.2848	78.5564	75.5136	73.7841	75.7019	77.8041	81.0711	84.8477	87.9024	(42a)
Hot water usage for baths	27.7205	27.3089	26.7291	25.6602	24.8598	23.9722	23.4928	24.0685	24.6953	25.6450	26.7360	27.6268	(42b)
Hot water usage for other uses	39.0344	37.6150	36.1955	34.7761	33.3567	31.9372	31.9372	33.3567	34.7761	36.1955	37.6150	39.0344	(42c)
Average daily hot water use (litres/day)													(43)
Daily hot water use	154.9955	151.8383	147.9067	141.7211	136.7728	131.4231	129.2142	133.1270	137.2755	142.9116	149.1986	154.5637	(44)
Energy content (annual)	245.4749	216.2157	227.3271	194.0091	184.1225	161.6000	156.2734	164.8391	169.2744	193.9297	212.5608	242.0093	(45)
Distribution loss (46)m = 0.15 x (45)m	36.8212	32.4323	34.0991	29.1014	27.6184	24.2400	23.4410	24.7259	25.3912	29.0895	31.8841	36.3014	(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													
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	(57)
Combi loss	5.5505	5.0023	5.5142	5.2843	5.4278	5.2195	5.3721	5.3892	5.2348	5.4474	5.3214	5.5435	(61)
Total heat required for water heating calculated for each month	251.0254	221.2180	232.8413	199.2934	189.5502	166.8195	161.6454	170.2283	174.5093	199.3771	217.8822	247.5529	(62)
WWHRS	-70.6854	-62.5147	-65.4618	-54.2050	-50.5171	-43.2278	-40.5192	-43.0881	-44.7252	-52.7260	-59.7322	-69.3764	(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	180.3400	158.7033	167.3795	145.0885	139.0332	123.5917	121.1262	127.1402	129.7841	146.6510	158.1500	178.1765	(64)
Total per year (kWh/year)													(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 =													(64a)
Heat gains from water heating, kWh/month	83.0080	73.1423	76.9648	65.8291	62.5777	55.0369	53.3039	56.1563	57.5925	65.8435	72.0068	81.8540	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.0422	121.8324	110.0422	113.7102	110.0422	113.7102	110.0422	110.0422	113.7102	110.0422	113.7102	110.0422	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0315	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156	(68)

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Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204 (71)
Water heating gains (Table 5)	111.5699	108.8427	103.4473	91.4293	84.1098	76.4401	71.6450	75.4789	79.9895	88.4993	100.0095	110.0188 (72)
Total internal gains	494.2793	505.5310	482.8299	462.7382	436.9286	415.9965	398.2269	399.8721	413.5663	433.1498	463.1500	483.4217 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.3200	10.6334	0.7100	0.7000		0.7700		4.8343 (74)	
East				6.4500	19.6403	0.7100	0.7000		0.7700		43.6311 (76)	
West				4.9500	19.6403	0.7100	0.7000		0.7700		33.4844 (80)	
Solar gains	81.9498	160.0929	264.1343	387.5446	478.0156	490.9255	466.7115	398.6707	307.8158	189.9987	102.1177	67.4462 (83)
Total gains	576.2291	665.6239	746.9642	850.2828	914.9442	906.9220	864.9384	798.5428	721.3820	623.1485	565.2677	550.8679 (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	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145	40.5145
alpha	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010	3.7010
util living area	0.9725	0.9533	0.9157	0.8278	0.6900	0.5234	0.3904	0.4379	0.6623	0.8783	0.9555	0.9764 (86)
MIT	19.4094	19.6671	20.0388	20.4811	20.7933	20.9433	20.9852	20.9773	20.8666	20.4313	19.8328	19.3449 (87)
Th 2	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581	20.0581 (88)
util rest of house	0.9673	0.9448	0.9003	0.7980	0.6412	0.4556	0.3102	0.3536	0.5946	0.8496	0.9458	0.9719 (89)
MIT 2	18.2102	18.5336	18.9947	19.5244	19.8722	20.0188	20.0511	20.0467	19.9550	19.4808	18.7467	18.1288 (90)
Living area fraction	18.4853	18.7936	19.2343	19.7438	20.0835	20.2309	20.2654	20.2602	20.1641	19.6989	18.9959	18.4078 (92)
MIT	18.3353	18.6436	19.0843	19.5938	19.9335	20.0809	20.1154	20.1102	20.0141	19.5489	18.8459	18.2578 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.2578 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9542	0.9281	0.8809	0.7814	0.6342	0.4573	0.3152	0.3584	0.5912	0.8310	0.9293	0.9600 (94)
Ext temp.	549.8621	617.7613	657.9983	664.3779	580.2896	414.6979	272.6436	286.2031	426.5005	517.8243	525.2954	528.8101 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Space heating kWh	1099.4284	1076.5812	985.7636	837.6810	644.9582	429.3333	275.3716	290.6293	463.2724	700.9923	920.0900	1101.1919 (97)
Space heating requirement - total per year (kWh/year)	408.8774	308.3270	243.8574	124.7783	48.1135	0.0000	0.0000	0.0000	0.0000	136.2770	284.2521	425.8521 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	408.8774	308.3270	243.8574	124.7783	48.1135	0.0000	0.0000	0.0000	0.0000	136.2770	284.2521	425.8521 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												1980.3347
Space heating per m2												(98c) / (4) = 26.0502 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	89.0000 (206)											
Efficiency of main space heating system 2 (in %)	0.0000 (207)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating efficiency (main heating system 1)	408.8774	308.3270	243.8574	124.7783	48.1135	0.0000	0.0000	0.0000	0.0000	136.2770	284.2521	425.8521 (98)
Space heating fuel (main heating system)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000 (210)
Space heating efficiency (main heating system 2)	459.4128	346.4348	273.9971	140.2003	54.0601	0.0000	0.0000	0.0000	0.0000	153.1202	319.3844	478.4855 (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)

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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 (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	180.3400	158.7033	167.3795	145.0885	139.0332	123.5917	121.1262	127.1402	129.7841	146.6510	158.1500	178.1765 (64)
Efficiency of water heater	88.4727	88.4149	88.3001	88.0779	87.7308	87.3000	87.3000	87.3000	87.3000	88.1107	88.3847	87.3000 (216)
Fuel for water heating, kWh/month	203.8369	179.4982	189.5574	164.7275	158.4770	141.5713	138.7471	145.6359	148.6645	166.4396	178.9337	201.3483 (217)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	9.0687	8.1911	9.0687	8.7762	9.0687	8.7762	9.0687	9.0687	8.7762	9.0687	8.7762	9.0687 (231)
Lighting	21.2127	17.0176	15.3225	11.2259	8.6712	7.0845	7.9102	10.2819	13.3552	17.5228	19.7919	21.8023 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-15.3554	-23.2326	-35.8837	-43.4465	-49.5865	-47.3043	-46.6896	-42.6592	-36.0895	-27.8283	-17.4217	-13.0929 (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)	-4.6792	-10.1994	-21.0548	-32.8624	-44.6866	-45.3812	-44.7710	-37.2504	-26.4958	-14.9100	-6.3423	-3.6726 (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												2225.0952 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												87.3000
Water heating fuel used												2017.4375 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 3.4040, total flow = 37.0000, SFP = 0.0920)												
mechanical ventilation fans (SFP = 0.0920)												20.7766 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												106.7766 (231)
Electricity for lighting (calculated in Appendix L)												171.1986 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-690.8958 (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												3829.6121 (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	2225.0952	0.2100	467.2700 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2017.4375	0.2100	423.6619 (264)
Space and water heating			890.9319 (265)
Pumps, fans and electric keep-hot	106.7766	0.1387	14.8112 (267)
Energy for lighting	171.1986	0.1443	24.7093 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-398.5901	0.1331	-53.0579
PV Unit electricity exported	-292.3056	0.1248	-36.4932
Total			-89.5511 (269)
Total CO2, kg/year			840.9013 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.0600 (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	2225.0952	1.1300	2514.3575 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2017.4375	1.1300	2279.7044 (278)
Space and water heating			4794.0619 (279)
Pumps, fans and electric keep-hot	106.7766	1.5128	161.5316 (281)
Energy for lighting	171.1986	1.5338	262.5902 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-398.5901	1.4919	-594.6494
PV Unit electricity exported	-292.3056	0.4582	-133.9398

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Total -728.5892 (283)
 Total Primary energy kWh/year 4489.5946 (286)
 Dwelling Primary energy Rate (DPER) 59.0600 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) -
First floor	38.0100 (1c)	x 2.5600 (2c)	= 97.3056 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 185.1087 (5)

2. Ventilation rate

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

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1621 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.4121	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3503 (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	0.4466	0.4378	0.4291	0.3853	0.3765	0.3327	0.3327	0.3240	0.3503	0.3765	0.3940	0.4116 (22b)
Effective ac	0.5997	0.5958	0.5920	0.5742	0.5709	0.5554	0.5554	0.5525	0.5613	0.5709	0.5776	0.5847 (25)

3. Heat losses and heat loss parameter

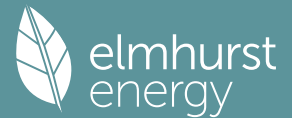
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type (Uw = 1.20)			12.7200	1.1450	14.5649		(27)
225mm TE Platinum BB			38.0100	0.1300	4.9413		(28a)
100mm Ecobead Platinum	85.2400	15.1000	70.1400	0.1800	12.6252		(29a)
Roof 1	38.0100		38.0100	0.1100	4.1811		(30)
Total net area of external elements Aum(A, m ²)			161.2600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.6925		(33)
Wall 1			38.9800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 150.2900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.2700	0.0500	0.2635
E2 Other lintels (including other steel lintels)	4.9400	0.0500	0.2470
E3 Sill	9.1900	0.0500	0.4595
E4 Jamb	17.6500	0.0500	0.8825
E5 Ground floor (normal)	17.5000	0.1600	2.8000
E6 Intermediate floor within a dwelling	17.5000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.5000	0.0600	0.5700
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	9.7400	0.0900	0.8766
E18 Party wall between dwellings	9.7400	0.0600	0.5844

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P1 Party wall - Ground floor	8.0000	0.0800	0.6400										
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000										
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.7635 (36)									
Point Thermal bridges				0.0000									
Total fabric heat loss		(33) + (36) + (36a) =		47.4560 (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	36.6342	36.3976	36.1658	35.0768	34.8731	33.9246	33.9246	33.7490	34.2899	34.8731	35.2852	35.7161	(38)
Average = Sum(39)m / 12 =	84.0901	83.8536	83.6218	82.5328	82.3291	81.3806	81.3806	81.2049	81.7459	82.3291	82.7412	83.1721	(39)
												82.5318	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1062	1.1030	1.1000	1.0857	1.0830	1.0705	1.0705	1.0682	1.0753	1.0830	1.0884	1.0941	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

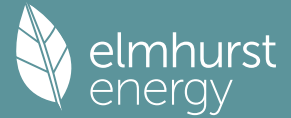
4. Water heating energy requirements (kWh/year)													
Assumed occupancy													2.3830 (42)
Hot water usage for mixer showers	64.1749	63.2195	61.8051	59.1163	57.1319	54.9190	53.6612	55.0559	56.5848	58.9608	61.7074	63.9290	(42a)
Hot water usage for baths	27.7205	27.3089	26.7291	25.6602	24.8598	23.9722	23.4928	24.0685	24.6953	25.6450	26.7360	27.6268	(42b)
Hot water usage for other uses	39.0344	37.6150	36.1955	34.7761	33.3567	31.9372	31.9372	33.3567	34.7761	36.1955	37.6150	39.0344	(42c)
Average daily hot water use (litres/day)												120.3543	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content	130.9299	128.1343	124.7298	119.5525	115.3483	110.8285	109.0912	112.4811	116.0562	120.8013	126.0584	130.5903	(44)
Energy content (annual)	207.3609	182.4616	191.7050	163.6614	155.2810	136.2765	131.9364	139.2751	143.1089	163.9263	179.5932	204.4728	(45)
Distribution loss (46)m = 0.15 x (45)m	31.1041	27.3692	28.7558	24.5492	23.2922	20.4415	19.7905	20.8913	21.4663	24.5889	26.9390	30.6709	(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													
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	(57)
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(59)
Total heat required for water heating calculated for each month	258.3198	228.4890	242.6639	212.9765	206.2399	185.5916	182.8953	190.2340	192.4240	214.8852	228.9083	255.4317	(62)
WWHRS	-29.3381	-25.9469	-27.1700	-22.4979	-20.9672	-17.9418	-16.8176	-17.8838	-18.5633	-21.8840	-24.7920	-28.7948	(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	228.9817	202.5421	215.4939	190.4786	185.2727	167.6498	166.0777	172.3502	173.8607	193.0011	204.1163	226.6369	(64)
12Total per year (kWh/year)												2326.4619	(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	81.6872	72.1753	76.4817	66.7462	64.3707	57.6407	56.6086	59.0487	59.9125	67.2452	72.0435	80.7269	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	110.0422	121.8324	110.0422	113.7102	110.0422	113.7102	110.0422	110.0422	113.7102	110.0422	113.7102	110.0422	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0315	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156	(68)
Pumps, fans	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	(71)
Total internal gains	109.7947	107.4037	102.7979	92.7030	86.5197	80.0565	76.0868	79.3665	83.2118	90.3833	100.0604	108.5039	(72)
	492.5040	504.0920	482.1805	464.0119	439.3386	419.6130	402.6687	403.7597	416.7885	435.0338	463.2009	481.9069	(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
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North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150 (76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115 (80)

Solar gains	72.7161	142.0543	234.3727	343.8776	424.1547	435.6099	414.1243	353.7500	273.1323	168.5904	90.6115	59.8466 (83)
Total gains	565.2201	646.1464	716.5532	807.8895	863.4932	855.2229	816.7930	757.5098	689.9208	603.6243	553.8124	541.7535 (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	37.7407	37.8472	37.9521	38.4529	38.5480	38.9973	38.9973	39.0817	38.8230	38.5480	38.3560	38.1573
alpha	3.5160	3.5231	3.5301	3.5635	3.5699	3.5998	3.5998	3.6054	3.5882	3.5699	3.5571	3.5438
util living area	0.9752	0.9597	0.9296	0.8552	0.7320	0.5645	0.4255	0.4728	0.6975	0.8938	0.9600	0.9784 (86)
MIT	19.2224	19.4777	19.8596	20.3552	20.7199	20.9199	20.9778	20.9676	20.8260	20.3359	19.7052	19.1870 (87)
Th 2	19.9958	19.9983	20.0008	20.0126	20.0147	20.0250	20.0250	20.0269	20.0210	20.0147	20.0103	20.0057 (88)
util rest of house	0.9704	0.9519	0.9159	0.8275	0.6831	0.4920	0.3365	0.3808	0.6285	0.8669	0.9510	0.9741 (89)
MIT 2	17.9332	18.2563	18.7348	19.3441	19.7600	19.9690	20.0146	20.0105	19.8851	19.3373	18.5554	17.8949 (90)
Living area fraction	18.2290	18.5365	18.9929	19.5761	19.9802	20.1871	20.2355	20.2301	20.1010	19.5664	18.8191	18.1913 (92)
MIT	18.2290	18.5365	18.9929	19.5761	19.9802	20.1871	20.2355	20.2301	20.1010	19.5664	18.8191	18.1913 (93)
Temperature adjustment												0.0000
adjusted MIT	18.2290	18.5365	18.9929	19.5761	19.9802	20.1871	20.2355	20.2301	20.1010	19.5664	18.8191	18.1913 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9585	0.9370	0.8986	0.8134	0.6813	0.5046	0.3562	0.4006	0.6346	0.8522	0.9366	0.9633 (94)
Useful gains	541.7825	605.4517	643.9176	657.1569	588.2615	431.5085	290.9394	303.4962	437.8343	514.4197	518.6875	521.8598 (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	1171.2890	1143.4694	1044.6747	881.1250	681.7023	454.6835	295.8626	311.0233	490.5557	738.1927	969.6566	1163.6864 (97)
Space heating kWh	468.3528	361.5479	298.1632	161.2570	69.5200	0.0000	0.0000	0.0000	0.0000	166.4871	324.6978	477.5190 (98a)
Space heating requirement - total per year (kWh/year)												2327.5448
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	468.3528	361.5479	298.1632	161.2570	69.5200	0.0000	0.0000	0.0000	0.0000	166.4871	324.6978	477.5190 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2327.5448
Space heating per m2										(98c) / (4) =		30.6175 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.4000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	468.3528	361.5479	298.1632	161.2570	69.5200	0.0000	0.0000	0.0000	0.0000	166.4871	324.6978	477.5190 (98)
Space heating efficiency (main heating system 1)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000 (210)
Space heating fuel (main heating system)	506.8754	391.2856	322.6875	174.5205	75.2380	0.0000	0.0000	0.0000	0.0000	180.1809	351.4046	516.7954 (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	228.9817	202.5421	215.4939	190.4786	185.2727	167.6498	166.0777	172.3502	173.8607	193.0011	204.1163	226.6369 (64)
Efficiency of water heater (217)m	85.8798	85.6080	85.0774	84.0266	82.4770	80.3000	80.3000	80.3000	80.3000	84.0663	85.3709	80.3000 (216)
Fuel for water heating, kWh/month	266.6304	236.5926	253.2916	226.6884	224.6357	208.7793	206.8216	214.6329	216.5140	229.5820	239.0937	263.7223 (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	22.8646	18.3428	16.5157	12.1001	9.3465	7.6361	8.5262	11.0826	14.3952	18.8873	21.3332	23.5001 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-35.5423	-50.0967	-71.9973	-80.9429	-87.2812	-81.4723	-80.4675	-75.9662	-68.0198	-57.2811	-39.0714	-30.7299 (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)

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Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-20.1119	-42.3073	-84.0866	-126.2887	-166.9807	-167.7719	-165.7950	-140.3784	-102.8954	-60.4996	-26.8515	-15.9038	(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												2518.9879	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												2786.9845	(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)												184.5303	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-1878.7394	(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												3697.7633	(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	2518.9879	0.2100	528.9875	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2786.9845	0.2100	585.2667	(264)
Space and water heating			1114.2542	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	184.5303	0.1443	26.6334	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-758.8686	0.1346	-102.1346	
PV Unit electricity exported	-1119.8708	0.1259	-140.9887	
Total			-243.1233	(269)
Total CO2, kg/year			909.6936	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.9700	(273)

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

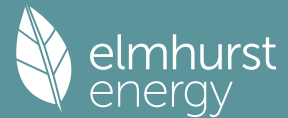
	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2518.9879	1.1300	2846.4563	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2786.9845	1.1300	3149.2924	(278)
Space and water heating			5995.7488	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	184.5303	1.5338	283.0388	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-758.8686	1.4974	-1136.3408	
PV Unit electricity exported	-1119.8708	0.4621	-517.5256	
Total			-1653.8665	(283)
Total Primary energy kWh/year			4755.0219	(286)
Target Primary Energy Rate (TPER)			62.5500	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
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Ground floor		38.0100 (1b)	x	2.3100 (2b)	=	87.8031 (1b) -
First floor		38.0100 (1c)	x	2.5600 (2c)	=	97.3056 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	185.1087 (5)

2. Ventilation rate

												m3 per hour
Number of open chimneys												0 * 80 = 0.0000 (6a)
Number of open flues												0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire												0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler												0 * 20 = 0.0000 (6d)
Number of flues attached to other heater												0 * 35 = 0.0000 (6e)
Number of blocked chimneys												0 * 20 = 0.0000 (6f)
Number of intermittent extract fans												3 * 10 = 30.0000 (7a)
Number of passive vents												0 * 10 = 0.0000 (7b)
Number of flueless gas fires												0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											30.0000 / (5) = 0.1621 (8)
Pressure test												Yes
Pressure Test Method												Blower Door
Measured/design AP50												4.0000 (17)
Infiltration rate												0.3621 (18)
Number of sides sheltered												2 (19)
Shelter factor												(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor												(21) = (18) x (20) = 0.3078 (21)

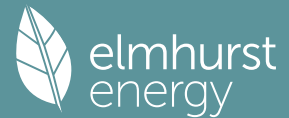
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3924	0.3847	0.3770	0.3385	0.3308	0.2924	0.2924	0.2847	0.3078	0.3308	0.3462	0.3616 (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	0.5770	0.5740	0.5711	0.5573	0.5547	0.5427	0.5427	0.5405	0.5474	0.5547	0.5599	0.5654 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Opening Type 1 (Uw = 1.20)			12.7200	1.1450	14.5649		(27)
Opening Type 3			2.3800	1.2000	2.8560		(26)
225mm TE Platinum BB			38.0100	0.1000	3.8010		(28a)
100mm Ecobead Platinum	85.2400	15.1000	70.1400	0.2400	16.8336		(29a)
Roof 1	38.0100		38.0100	0.0900	3.4209		(30)
Total net area of external elements Aum(A, m2)			161.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.4764		(33)
Wall 1			38.9800	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							150.2900 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value		Total
E2 Other lintels (including other steel lintels)				5.2700	0.0320		0.1686
E2 Other lintels (including other steel lintels)				4.9400	0.0320		0.1581
E3 Sill				9.1900	0.0310		0.2849
E4 Jamb				17.6500	0.0360		0.6354
E5 Ground floor (normal)				17.5000	0.0590		1.0325
E6 Intermediate floor within a dwelling				17.5000	0.0060		0.1050
E10 Eaves (insulation at ceiling level)				9.5000	0.1030		0.9785
E10 Eaves (insulation at ceiling level)				8.0000	0.0780		0.6240
E16 Corner (normal)				9.7400	0.0520		0.5065
E18 Party wall between dwellings				9.7400	0.0530		0.5162
P1 Party wall - Ground floor				8.0000	0.0860		0.6880
P2 Party wall - Intermediate floor within a dwelling				8.0000	0.0000		0.0000
P4 Party wall - Roof (insulation at ceiling level)				8.0000	0.0770		0.6160
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3137 (36)
Point Thermal bridges							0.0000 (36a)
Total fabric heat loss						(33) + (36) + (36a) =	47.7901 (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	35.2456	35.0630	34.8840	34.0433	33.8860	33.1537	33.1537	33.0181	33.4358	33.8860	34.2042	34.5369 (38)
Average = Sum(39)m / 12 =	83.0357	82.8531	82.6741	81.8334	81.6761	80.9438	80.9438	80.8082	81.2259	81.6761	81.9943	82.3270 (39)
												81.8326
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0923	1.0899	1.0875	1.0765	1.0744	1.0648	1.0648	1.0630	1.0685	1.0744	1.0786	1.0830 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3830 (42)
Hot water usage for mixer showers												0.0000 (42a)
Hot water usage for baths	27.7205	27.3089	26.7291	25.6602	24.8598	23.9722	23.4928	24.0685	24.6953	25.6450	26.7360	27.6268 (42b)
Hot water usage for other uses	39.0344	37.6150	36.1955	34.7761	33.3567	31.9372	31.9372	33.3567	34.7761	36.1955	37.6150	39.0344 (42c)
Average daily hot water use (litres/day)												61.1871 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	66.7549	64.9238	62.9246	60.4363	58.2164	55.9095	55.4301	57.4252	59.4714	61.8406	64.3509	66.6612 (44)
Energy content (annual)	105.7235	92.4507	96.7128	82.7342	78.3705	68.7472	67.0379	71.1044	73.3342	83.9170	91.6797	104.3754 (45)
Distribution loss (46)m = 0.15 x (45)m												1016.1875
Water storage loss:												0.0000 (46)
Total storage loss												0.0000 (56)
If cylinder contains dedicated solar storage												0.0000 (57)
Primary loss												0.0000 (59)
Combi loss												0.0000 (61)
Total heat required for water heating calculated for each month												88.7191 (62)
WWHRS												0.0000 (63a)
PV diverter												0.0000 (63b)
Solar input												0.0000 (63c)
FGHRS												0.0000 (63d)
Output from w/h	89.8650	78.5831	82.2059	70.3241	66.6149	58.4351	56.9822	60.4387	62.3341	71.3295	77.9278	88.7191 (64)
12Total per year (kWh/year)												863.7594 (64)
Electric shower(s)	51.3934	45.7920	50.0031	47.7173	48.6127	46.3718	47.9175	48.6127	47.7173	50.0031	49.0628	51.3934 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												584.5971 (64a)
Heat gains from water heating, kWh/month	35.3146	31.0938	33.0522	29.5104	28.8069	26.2017	26.2249	27.2629	27.5129	30.3331	31.7476	35.0281 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.0422	121.8324	110.0422	113.7102	110.0422	113.7102	110.0422	110.0422	113.7102	110.0422	113.7102	110.0422 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0315	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204 (71)
Water heating gains (Table 5)	47.4659	46.2705	44.4251	40.9866	38.7190	36.3913	35.2486	36.6436	38.2123	40.7703	44.0939	47.0808 (72)
Total internal gains	427.1752	439.9588	420.8076	409.2954	388.5378	375.9477	361.8305	361.0368	371.7890	382.4208	404.2344	417.4837 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			1.3200		10.6334		0.7100		0.7000		0.7700		4.8343 (74)
East			6.4500		19.6403		0.7100		0.7000		0.7700		43.6311 (76)
West			4.9500		19.6403		0.7100		0.7000		0.7700		33.4844 (80)
Solar gains	81.9498	160.0929	264.1343	387.5446	478.0156	490.9255	466.7115	398.6707	307.8158	189.9987	102.1177	67.4462	(83)
Total gains	509.1251	600.0517	684.9419	796.8400	866.5534	866.8732	828.5420	759.7075	679.6048	572.4196	506.3522	484.9299	(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	38.2200	38.3042	38.3872	38.7815	38.8562	39.2077	39.2077	39.2735	39.0716	38.8562	38.7054	38.5490
alpha	3.5480	3.5536	3.5591	3.5854	3.5904	3.6138	3.6138	3.6182	3.6048	3.5904	3.5804	3.5699
util living area	0.9817	0.9670	0.9366	0.8579	0.7280	0.5563	0.4180	0.4698	0.7020	0.9055	0.9688	0.9845 (86)

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MIT	19.1450	19.4225	19.8329	20.3561	20.7294	20.9246	20.9793	20.9687	20.8245	20.3041	19.6372	19.1009 (87)
Th 2	20.0071	20.0091	20.0110	20.0201	20.0218	20.0297	20.0297	20.0312	20.0267	20.0218	20.0184	20.0148 (88)
util rest of house	0.9780	0.9604	0.9240	0.8306	0.6791	0.4846	0.3308	0.3786	0.6334	0.8808	0.9615	0.9813 (89)
MIT 2	18.3207	18.5953	18.9971	19.4989	19.8302	19.9887	20.0222	20.0189	19.9195	19.4642	18.8168	18.2825 (90)
Living area fraction	18.5098	18.7851	19.1889	19.6955	20.0365	20.2034	20.2418	20.2368	20.1271	19.6569	19.0050	18.4703 (92)
MIT	18.5098	18.7851	19.1889	19.6955	20.0365	20.2034	20.2418	20.2368	20.1271	19.6569	19.0050	18.4703 (93)
Temperature adjustment												0.0000
adjusted MIT	18.5098	18.7851	19.1889	19.6955	20.0365	20.2034	20.2418	20.2368	20.1271	19.6569	19.0050	18.4703 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9705	0.9501	0.9112	0.8203	0.6799	0.4979	0.3503	0.3985	0.6411	0.8698	0.9517	0.9746 (94)
Useful gains	494.1267	570.0938	624.0914	653.6803	589.1963	431.6469	290.2047	302.7598	435.6978	497.8854	481.9034	472.6198 (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	1179.9209	1150.4209	1049.0404	883.4355	680.8894	453.5626	294.7785	310.0433	489.5570	739.7281	976.1420	1174.8293 (97)
Space heating kWh	510.2310	389.9798	316.1620	165.4237	68.2197	0.0000	0.0000	0.0000	0.0000	179.9309	355.8518	522.4438 (98a)
Space heating requirement - total per year (kWh/year)												2508.2428
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	510.2310	389.9798	316.1620	165.4237	68.2197	0.0000	0.0000	0.0000	0.0000	179.9309	355.8518	522.4438 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2508.2428
Space heating per m2										(98c) / (4) =		32.9945 (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	760.8720	598.9843	614.1425	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8665	0.9155	0.8891	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	659.3209	548.3890	546.0614	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	968.5743	926.0148	847.7343	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	222.6625	280.9535	224.4447	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	55.6656	70.2384	56.1112	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												182.0152 (107)
Energy for space heating												32.9945 (99)
Energy for space cooling												2.3943 (108)
Total												35.3888 (109)
Fabric Energy Efficiency (DFEE)												35.4 (109)

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

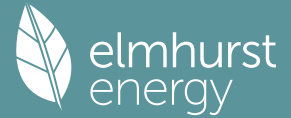
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	38.0100 (1b)	x 2.3100 (2b)	= 87.8031 (1b) -
First floor	38.0100 (1c)	x 2.5600 (2c)	= 97.3056 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	76.0200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	185.1087 (5)

2. Ventilation rate

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

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

Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	Air changes per hour 30.0000 / (5) =	0.1621 (8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000 (17)	
Infiltration rate		0.4121 (18)	
Number of sides sheltered		2 (19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3503 (21)	

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.4466	0.4378	0.4291	0.3853	0.3765	0.3327	0.3327	0.3240	0.3503	0.3765	0.3940	0.4116 (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	0.5997	0.5958	0.5920	0.5742	0.5709	0.5554	0.5554	0.5525	0.5613	0.5709	0.5776	0.5847 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.3800	1.0000	2.3800		(26)
TER Opening Type (Uw = 1.20)			12.7200	1.1450	14.5649		(27)
225mm TE Platinum BB			38.0100	0.1300	4.9413		(28a)
100mm Ecobead Platinum	85.2400	15.1000	70.1400	0.1800	12.6252		(29a)
Roof 1	38.0100		38.0100	0.1100	4.1811		(30)
Total net area of external elements Aum(A, m2)			161.2600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.6925		(33)
Wall 1			38.9800	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 150.2900 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	5.2700	0.0500	0.2635
E2 Other lintels (including other steel lintels)	4.9400	0.0500	0.2470
E3 Sill	9.1900	0.0500	0.4595
E4 Jamb	17.6500	0.0500	0.8825
E5 Ground floor (normal)	17.5000	0.1600	2.8000
E6 Intermediate floor within a dwelling	17.5000	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	9.5000	0.0600	0.5700
E10 Eaves (insulation at ceiling level)	8.0000	0.0600	0.4800
E16 Corner (normal)	9.7400	0.0900	0.8766
E18 Party wall between dwellings	9.7400	0.0600	0.5844
P1 Party wall - Ground floor	8.0000	0.0800	0.6400
P2 Party wall - Intermediate floor within a dwelling	8.0000	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	8.0000	0.1200	0.9600

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7635 (36)

Point Thermal Bridges

Total fabric heat loss (33) + (36) + (36a) = 47.4560 (37)

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

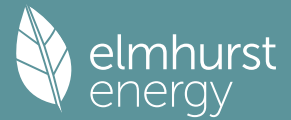
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	36.6342	36.3976	36.1658	35.0768	34.8731	33.9246	33.9246	33.7490	34.2899	34.8731	35.2852	35.7161 (38)
Heat transfer coeff	84.0901	83.8536	83.6218	82.5328	82.3291	81.3806	81.3806	81.2049	81.7459	82.3291	82.7412	83.1721 (39)
Average = Sum(39)m / 12 =												82.5318

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1.1062	1.1030	1.1000	1.0857	1.0830	1.0705	1.0705	1.0682	1.0753	1.0830	1.0884	1.0941 (40)
HLP (average)												1.0857
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3830 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	27.7205	27.3089	26.7291	25.6602	24.8598	23.9722	23.4928	24.0685	24.6953	25.6450	26.7360	27.6268 (42b)
Hot water usage for other uses	39.0344	37.6150	36.1955	34.7761	33.3567	31.9372	31.9372	33.3567	34.7761	36.1955	37.6150	39.0344 (42c)
Average daily hot water use (litres/day)												61.1871 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	66.7549	64.9238	62.9246	60.4363	58.2164	55.9095	55.4301	57.4252	59.4714	61.8406	64.3509	66.6612 (44)

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Energy content (annual)	105.7235	92.4507	96.7128	82.7342	78.3705	68.7472	67.0379	71.1044	73.3342	83.9170	91.6797	104.3754 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1016.1875
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	89.8650	78.5831	82.2059	70.3241	66.6149	58.4351	56.9822	60.4387	62.3341	71.3295	77.9278	88.7191 (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	89.8650	78.5831	82.2059	70.3241	66.6149	58.4351	56.9822	60.4387	62.3341	71.3295	77.9278	88.7191 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											863.7594 (64)
Electric shower(s)	51.3934	45.7920	50.0031	47.7173	48.6127	46.3718	47.9175	48.6127	47.7173	50.0031	49.0628	51.3934 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											584.5971 (64a)
Heat gains from water heating, kWh/month	35.3146	31.0938	33.0522	29.5104	28.8069	26.2017	26.2249	27.2629	27.5129	30.3331	31.7476	35.0281 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505	119.1505 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	110.0422	121.8324	110.0422	113.7102	110.0422	113.7102	110.0422	110.0422	113.7102	110.0422	113.7102	110.0422 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	210.9220	213.1108	207.5953	195.8535	181.0315	167.1010	157.7946	155.6059	161.1214	172.8632	187.6851	201.6156 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150	34.9150 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204	-95.3204 (71)
Water heating gains (Table 5)	47.4659	46.2705	44.4251	40.9866	38.7190	36.3913	35.2486	36.6436	38.2123	40.7703	44.0939	47.0808 (72)
Total internal gains	427.1752	439.9588	420.8076	409.2954	388.5378	375.9477	361.8305	361.0368	371.7890	382.4208	404.2344	417.4837 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.3200	10.6334	0.6300	0.7000	0.7700	4.2896 (74)
East	6.4500	19.6403	0.6300	0.7000	0.7700	38.7150 (76)
West	4.9500	19.6403	0.6300	0.7000	0.7700	29.7115 (80)

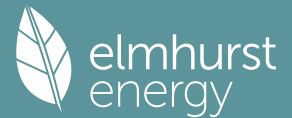
Solar gains	72.7161	142.0543	234.3727	343.8776	424.1547	435.6099	414.1243	353.7500	273.1323	168.5904	90.6115	59.8466 (83)
Total gains	499.8913	582.0131	655.1803	753.1731	812.6925	811.5576	775.9547	714.7869	644.9213	551.0113	494.8459	477.3303 (84)

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	37.7407	37.8472	37.9521	38.4529	38.5480	38.9973	38.9973	39.0817	38.8230	38.5480	38.3560	38.1573
alpha	3.5160	3.5231	3.5301	3.5635	3.5699	3.5998	3.5998	3.6054	3.5882	3.5699	3.5571	3.5438
util living area	0.9828	0.9700	0.9442	0.8758	0.7573	0.5882	0.4457	0.4973	0.7269	0.9147	0.9710	0.9853 (86)
MIT	19.0975	19.3618	19.7605	20.2896	20.6851	20.9086	20.9742	20.9619	20.7999	20.2615	19.5980	19.0621 (87)
Th 2	19.9958	19.9983	20.0008	20.0126	20.0147	20.0250	20.0250	20.0269	20.0210	20.0147	20.0103	20.0057 (88)
util rest of house	0.9793	0.9640	0.9328	0.8506	0.7099	0.5145	0.3534	0.4020	0.6592	0.8917	0.9642	0.9822 (89)
MIT 2	18.2656	18.5280	18.9201	19.4331	19.7891	19.9746	20.0155	20.0117	19.8973	19.4198	18.7727	18.2376 (90)
Living area fraction	fLA = Living area / (4) =											0.2294 (91)
MIT	18.4565	18.7193	19.1129	19.6296	19.9946	20.1889	20.2354	20.2297	20.1043	19.6129	18.9620	18.4267 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4565	18.7193	19.1129	19.6296	19.9946	20.1889	20.2354	20.2297	20.1043	19.6129	18.9620	18.4267 (93)

8. Space heating requirement

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9720	0.9540	0.9202	0.8393	0.7088	0.5275	0.3739	0.4226	0.6655	0.8803	0.9546	0.9757	(94)
Useful gains	485.8908	555.2233	602.9123	632.1279	576.0541	428.0961	290.0942	302.0553	429.1900	485.0676	472.3824	465.7325	(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	1190.4181	1158.8007	1054.7106	885.5455	682.8881	454.8251	295.8524	310.9910	490.8306	742.0204	981.4784	1183.2689	(97)
Space heating kWh	524.1683	405.6040	336.1379	182.4607	79.4845	0.0000	0.0000	0.0000	0.0000	191.1729	366.5491	533.8471	(98a)
Space heating requirement - total per year (kWh/year)												2619.4245	
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	524.1683	405.6040	336.1379	182.4607	79.4845	0.0000	0.0000	0.0000	0.0000	191.1729	366.5491	533.8471	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2619.4245	
Space heating per m2										(98c) / (4) =		34.4570	(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	764.9775	602.2164	617.1576	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8427	0.8981	0.8697	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	644.6571	540.8729	536.7269	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	903.9198	864.5492	795.2296	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	186.6692	240.8151	192.3261	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	46.6673	60.2038	48.0815	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling requirement												154.9526	(107)
Energy for space heating												34.4570	(99)
Energy for space cooling												2.0383	(108)
Total												36.4954	(109)
Fabric Energy Efficiency (TFEE)												36.5	(109)

Full SAP Calculation Printout



Property Reference	4 Bedroom Det 21 X			Issued on Date	30/01/2023
Assessment Reference	1	Prop Type Ref			
Property	Plot x, Maidstone, ME20				
SAP Rating	95 A	DER	10.00	TER	10.13
Environmental	90 B	% DER < TER			1.28
CO ₂ Emissions (t/year)	1.07	DFEE	41.92	TFEE	42.05
Compliance Check	See BREL	% DFEE < TFEE			0.31
% DPER < TPER	1.27	DPER	52.29	TPER	52.96
Assessor Details	Ms. Hazel Black			Assessor ID	M003-0001
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	65.7500 (1b)	x 2.3300 (2b)	= 153.1975 (1b) -
First floor	61.6300 (1c)	x 2.5600 (2c)	= 157.7728 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	310.9703 (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	0 * 10 = 0.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)

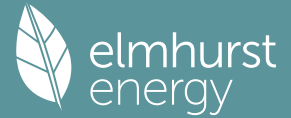
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	4.0000	(17)
Infiltration rate	0.2000	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2167	0.2125	0.2083	0.1870	0.1827	0.1615	0.1615	0.1573	0.1700	0.1827	0.1913	0.1998 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

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
Opening Type 1 (Uw = 1.20)			27.5900	1.1450	31.5916		(27)
Opening Type 6			4.3200	1.5000	6.4800		(26a)
225mm Beam & Block			65.7500	0.1100	7.2325		(28a)

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100mm Ecobead Platinum	162.9100	31.9100	131.0000	0.2400	31.4400	(29a)
Flat Roof	3.4100		3.4100	0.1700	0.5797	(30)
500mm mineral wool	61.6300		61.6300	0.0900	5.5467	(30)
Total net area of external elements Aum(A, m2)			293.7000			(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		82.8705	(33)

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

148.5300 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.7700	0.0320	0.2486
E2 Other lintels (including other steel lintels)	4.9000	0.0320	0.1568
E3 Sill	18.0500	0.0310	0.5595
E4 Jamb	37.0600	0.0360	1.3342
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	4.2000	0.1000	0.4200
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	3.0000	0.1000	0.3000
E5 Ground floor (normal)	34.7800	0.0590	2.0520
E6 Intermediate floor within a dwelling	31.9800	0.0060	0.1919
E10 Eaves (insulation at ceiling level)	19.0300	0.0740	1.4082
E24 Eaves (insulation at ceiling level - inverted)	3.3700	0.1500	0.5055
E12 Gable (insulation at ceiling level)	12.9500	0.0570	0.7381
E14 Flat roof	7.1300	0.1600	1.1408
E16 Corner (normal)	19.5600	0.0520	1.0171

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

10.6032 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 93.4737 (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	(38)
Heat transfer coeff	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	51.3101	
Average = Sum(39)m / 12 =	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	144.7838	(39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(40)
HLP (average)	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	1.1366	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

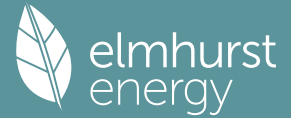
4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.8879 (42)
Hot water usage for mixer showers													
72.6398	71.5481	69.9574	66.9138	64.6678	62.1630	60.7392	62.3179	64.0484	66.7378	69.8468	72.3614	72.3614	(42a)
Hot water usage for baths													
31.3607	30.8949	30.2391	29.0298	28.1242	27.1202	26.5778	27.2291	27.9382	29.0126	30.2468	31.2547	31.2547	(42b)
Hot water usage for other uses													
44.2046	42.5971	40.9897	39.3823	37.7748	36.1674	36.1674	37.7748	39.3823	40.9897	42.5971	44.2046	44.2046	(42c)
Average daily hot water use (litres/day)													136.2337 (43)
Daily hot water use													
148.2050	145.0402	141.1862	135.3259	130.5668	125.4505	123.4844	127.3218	131.3689	136.7402	142.6908	147.8207	147.8207	(44)
Energy conte	234.7206	206.5353	216.9979	185.2543	175.7680	154.2560	149.3437	157.6510	161.9910	185.5551	203.2892	231.4515	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
35.2081	30.9803	32.5497	27.7882	26.3652	23.1384	22.4016	23.6477	24.2987	27.8333	30.4934	34.7177	34.7177	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.5400 (55)
Total storage loss													
16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	(56)
If cylinder contains dedicated solar storage													
16.7400	15.1200	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	16.2000	16.7400	16.2000	16.7400	16.7400	(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													
274.7230	242.6665	257.0003	223.9663	215.7704	192.9680	189.3461	197.6534	200.7030	225.5575	242.0012	271.4539	271.4539	(62)
WWHRS	-32.3421	-28.6036	-29.9521	-24.8015	-23.1141	-19.7789	-18.5396	-19.7150	-20.4640	-24.1248	-27.3305	-31.7432	(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													
242.3809	214.0629	227.0482	199.1649	192.6563	173.1891	170.8065	177.9385	180.2390	201.4327	214.6707	239.7107	239.7107	(64)
Total per year (kWh/year)													
2433.3006													(64)
12Total per year (kWh/year)													
2433													(64)
Electric shower(s)													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
110.0465	97.5780	104.1537	92.5667	90.4448	82.2597	81.6587	84.4209	84.8316	93.6990	98.5632	108.9595	108.9595	(65)

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

Metabolic gains (Table 5), Watts

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	(66)
Lighting gains	(calculated in Appendix L, equation L9 or L9a), also see Table 5												
	148.6994	164.6315	148.6994	153.6561	148.6994	153.6561	148.6994	148.6994	153.6561	148.6994	153.6561	148.6994	(67)
Appliances gains	(calculated in Appendix L, equation L13 or L13a), also see Table 5												
	294.5343	297.5906	289.8887	273.4923	252.7948	233.3421	220.3464	217.2901	224.9920	241.3884	262.0859	281.5386	(68)
Cooking gains	(calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	(71)
Water heating gains (Table 5)	147.9120	145.2053	139.9916	128.5648	121.5656	114.2496	109.7563	113.4689	117.8217	125.9395	136.8934	146.4510	(72)
Total internal gains	660.4636	676.7453	647.8976	625.0311	592.3777	567.5657	545.1201	545.7764	562.7877	585.3452	621.9533	646.0070	(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				9.0900	11.2829		0.7100		0.7000		0.7700		35.3245 (75)		
East				0.7400	19.6403		0.7100		0.7000		0.7700		5.0057 (76)		
Southeast				4.0600	36.7938		0.7100		0.7000		0.7700		51.4506 (77)		
South				0.7400	46.7521		0.7100		0.7000		0.7700		11.9158 (78)		
Southwest				4.0900	36.7938		0.7100		0.7000		0.7700		51.8308 (79)		
Northwest				8.8700	11.2829		0.7100		0.7000		0.7700		34.4695 (81)		
Solar gains				189.9970	347.3015	537.6564	770.2283	957.2165	991.7343	938.9015	793.1479	617.2543	400.7224	231.8921	159.7975 (83)
Total gains				850.4606	1024.0469	1185.5540	1395.2594	1549.5942	1559.2999	1484.0216	1338.9243	1180.0420	986.0677	853.8454	805.8045 (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	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988	36.2988
alpha	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199	3.4199
util living area	0.9816	0.9654	0.9330	0.8527	0.7167	0.5491	0.4154	0.4734	0.7056	0.9041	0.9686	0.9846 (86)
MIT	19.0313	19.3306	19.7647	20.3008	20.7065	20.9124	20.9743	20.9600	20.7930	20.2361	19.5258	18.9617 (87)
Th 2	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710	19.9710 (88)
util rest of house	0.9779	0.9586	0.9196	0.8242	0.6658	0.4744	0.3239	0.3769	0.6346	0.8787	0.9612	0.9815 (89)
MIT 2	17.6775	18.0555	18.5985	19.2482	19.7065	19.9106	19.9593	19.9512	19.8096	19.1885	18.3070	17.5893 (90)
Living area fraction	fLA = Living area / (4) =											0.1956 (91)
MIT	17.9422	18.3048	18.8266	19.4540	19.9021	20.1065	20.1578	20.1485	20.0019	19.3934	18.5453	17.8577 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7922	18.1548	18.6766	19.3040	19.7521	19.9565	20.0078	19.9985	19.8519	19.2434	18.3953	17.7077 (93)

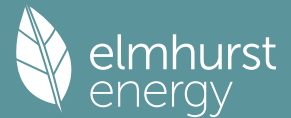
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9663	0.9419	0.8980	0.8024	0.6540	0.4733	0.3273	0.3795	0.6255	0.8559	0.9451	0.9711	(94)
Useful gains	821.7882	964.6004	1064.6643	1119.5887	1013.3786	738.0590	485.7104	508.1849	738.0832	843.9500	806.9900	782.5029	(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	1953.4591	1919.0876	1762.9686	1506.3330	1165.8148	775.5383	493.3919	520.9978	832.7867	1251.4233	1635.3782	1955.6917	(97)
Space heating kWh	841.9632	641.4153	519.5384	278.4559	113.4125	0.0000	0.0000	0.0000	0.0000	303.1602	596.4394	872.8524	(98a)
Space heating requirement - total per year (kWh/year)													4167.2374
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)													0.0000
Space heating kWh	841.9632	641.4153	519.5384	278.4559	113.4125	0.0000	0.0000	0.0000	0.0000	303.1602	596.4394	872.8524	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													4167.2374
Space heating per m2													(98c) / (4) = 32.7150 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													88.7000	(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		

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Space heating requirement	841.9632	641.4153	519.5384	278.4559	113.4125	0.0000	0.0000	0.0000	0.0000	303.1602	596.4394	872.8524 (98)
Space heating efficiency (main heating system 1)	88.7000	88.7000	88.7000	88.7000	88.7000	0.0000	0.0000	0.0000	0.0000	88.7000	88.7000	88.7000 (210)
Space heating fuel (main heating system)	949.2257	723.1289	585.7253	313.9300	127.8608	0.0000	0.0000	0.0000	0.0000	341.7815	672.4233	984.0501 (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	242.3809	214.0629	227.0482	199.1649	192.6563	173.1891	170.8065	177.9385	180.2390	201.4327	214.6707	239.7107 (64)
Efficiency of water heater	86.5162	86.2625	85.7550	84.7111	82.8136	79.7000	79.7000	79.7000	79.7000	84.8740	86.1260	79.7000 (216)
Fuel for water heating, kWh/month	280.1566	248.1528	264.7638	235.1107	232.6385	217.3013	214.3119	223.2603	226.1468	237.3315	249.2519	276.8241 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	10.2685	9.2748	10.2685	9.9373	10.2685	9.9373	10.2685	10.2685	9.9373	10.2685	9.9373	10.2685 (231)
Lighting	29.7042	23.8298	21.4561	15.7197	12.1423	9.9204	11.0766	14.3978	18.7014	24.5372	27.7147	30.5298 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-53.2060	-74.2536	-105.6720	-117.5849	-125.7407	-116.9394	-115.4093	-109.3954	-98.7263	-84.2238	-58.1883	-46.0819 (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)	-32.4495	-67.9625	-134.5518	-201.3589	-265.5860	-266.6645	-263.6057	-223.5738	-164.3239	-97.0488	-43.2715	-25.6906 (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												4698.1256 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												79.7000
Water heating fuel used												2905.2504 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 4.1400, total flow = 45.0000, SFP = 0.0920)												
mechanical ventilation fans (SFP = 0.0920)												34.9033 (230a)
central heating pump												41.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												120.9033 (231)
Electricity for lighting (calculated in Appendix L)												239.7303 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-2891.5091 (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												5072.5005 (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	4698.1256	0.2100	986.6064 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2905.2504	0.2100	610.1026 (264)
Space and water heating			1596.7090 (265)
Pumps, fans and electric keep-hot	120.9033	0.1387	16.7708 (267)
Energy for lighting	239.7303	0.1443	34.6005 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1105.4216	0.1348	-149.0257
PV Unit electricity exported	-1786.0875	0.1260	-225.0409
Total			-374.0665 (269)
Total CO2, kg/year			1274.0137 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.0000 (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	4698.1256	1.1300	5308.8819 (275)

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Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2905.2504	1.1300	3282.9329 (278)
Space and water heating			8591.8148 (279)
Pumps, fans and electric keep-hot	120.9033	1.5128	182.9025 (281)
Energy for lighting	239.7303	1.5338	367.7063 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1105.4216	1.4983	-1656.2092
PV Unit electricity exported	-1786.0875	0.4625	-826.0622
Total			-2482.2714 (283)
Total Primary energy kWh/year			6660.1523 (286)
Dwelling Primary energy Rate (DPER)			52.2900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.7500 (1b)	x 2.3300 (2b)	= 153.1975 (1b) -
First floor	61.6300 (1c)	x 2.5600 (2c)	= 157.7728 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.9703 (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) = 0.1286 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3786 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.3218 (21)

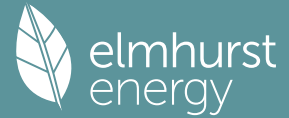
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4103	0.4023	0.3942	0.3540	0.3460	0.3057	0.3057	0.2977	0.3218	0.3460	0.3621	0.3782 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (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			4.3200	1.0000	4.3200		(26a)
TER Opening Type (Uw = 1.20)			27.5700	1.1450	31.5687		(27)
225mm Beam & Block			65.7500	0.1300	8.5475		(28a)
100mm Ecobead Platinum	162.9100	31.8900	131.0200	0.1800	23.5836		(29a)
Flat Roof	3.4100		3.4100	0.1100	0.3751		(30)
500mm mineral wool	61.6300		61.6300	0.1100	6.7793		(30)
Total net area of external elements Aum(A, m ²)			293.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.1742		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.5300 (35)
List of Thermal Bridges							
K1 Element				Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)				7.7700	0.0500	0.3885	

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.7044	164.6370	148.7044	153.6612	148.7044	153.6612	148.7044	148.7044	153.6612	148.7044	153.6612	148.7044 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.5343	297.5906	289.8887	273.4923	252.7948	233.3421	220.3464	217.2901	224.9920	241.3884	262.0859	281.5386 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393 (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)												

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	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144 (71)
Water heating gains (Table 5)	155.0007	152.2940	147.0803	135.6535	128.6543	121.3383	116.8450	120.5576	124.9104	133.0282	143.9821	153.5397 (72)
Total internal gains	667.5572	683.8395	654.9913	632.1249	599.4714	574.6595	552.2137	552.8700	569.8814	592.4389	629.0471	653.1006 (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				9.0900	11.2829		0.6300		0.7000		0.7700		31.3443 (75)
East				0.7400	19.6403		0.6300		0.7000		0.7700		4.4417 (76)
Southeast				4.0600	36.7938		0.6300		0.7000		0.7700		45.6534 (77)
South				0.7400	46.7521		0.6300		0.7000		0.7700		10.5731 (78)
Southwest				4.0900	36.7938		0.6300		0.7000		0.7700		45.9907 (79)
Northwest				8.8500	11.2829		0.6300		0.7000		0.7700		30.5167 (81)
Solar gains	168.5199	308.0286	476.8224	683.0266	848.8028	879.3943	832.5530	703.3352	547.3963	355.3991	205.6767	141.7358	(83)
Total gains	836.0771	991.8681	1131.8137	1315.1516	1448.2741	1454.0538	1384.7667	1256.2052	1117.2778	947.8379	834.7237	794.8365	(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	35.0702	35.1489	35.2264	35.5949	35.6647	35.9933	35.9933	36.0548	35.8660	35.6647	35.5238	35.3776
alpha	3.3380	3.3433	3.3484	3.3730	3.3776	3.3996	3.3996	3.4037	3.3911	3.3776	3.3683	3.3585
util living area	0.9827	0.9690	0.9420	0.8728	0.7498	0.5831	0.4450	0.5024	0.7323	0.9143	0.9709	0.9853 (86)
MIT	18.9317	19.2194	19.6483	20.2105	20.6481	20.8925	20.9675	20.9511	20.7610	20.1763	19.4608	18.8871 (87)
Th 2	19.9389	19.9410	19.9431	19.9529	19.9547	19.9632	19.9632	19.9648	19.9599	19.9547	19.9510	19.9471 (88)
util rest of house	0.9791	0.9627	0.9300	0.8465	0.7002	0.5061	0.3478	0.4014	0.6622	0.8906	0.9640	0.9823 (89)
MIT 2	17.5312	17.8965	18.4364	19.1303	19.6337	19.8881	19.9482	19.9403	19.7711	19.1066	18.2127	17.4796 (90)
Living area fraction									fLA = Living area / (4) =			0.1956 (91)
MIT	17.8051	18.1552	18.6734	19.3415	19.8320	20.0845	20.1475	20.1379	19.9647	19.3158	18.4568	17.7549 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8051	18.1552	18.6734	19.3415	19.8320	20.0845	20.1475	20.1379	19.9647	19.3158	18.4568	17.7549 (93)

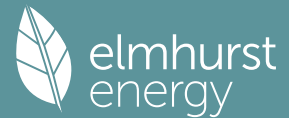
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9686	0.9481	0.9113	0.8284	0.6938	0.5156	0.3657	0.4191	0.6626	0.8723	0.9500	0.9729 (94)
Useful gains	809.8511	940.3494	1031.4360	1089.4361	1004.8347	749.7558	506.3752	526.4207	740.2860	826.8406	792.9480	773.2583 (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	2023.8189	1981.9194	1816.1674	1541.6588	1198.3237	800.8127	517.9848	544.8556	859.3562	1284.3439	1680.1504	2013.6291 (97)
Space heating kWh	903.1921	699.9350	583.8401	325.6004	143.9558	0.0000	0.0000	0.0000	0.0000	340.3824	638.7857	922.8359 (98a)
Space heating requirement - total per year (kWh/year)												4558.5275
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	903.1921	699.9350	583.8401	325.6004	143.9558	0.0000	0.0000	0.0000	0.0000	340.3824	638.7857	922.8359 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												4558.5275
Space heating per m2										(98c) / (4) =		35.7868 (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	903.1921	699.9350	583.8401	325.6004	143.9558	0.0000	0.0000	0.0000	0.0000	340.3824	638.7857	922.8359 (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)	978.5396	758.3261	632.5462	352.7631	155.9651	0.0000	0.0000	0.0000	0.0000	368.7784	692.0756	999.8222 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)

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Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating													
Water heating requirement	248.1076	219.2517	232.8390	204.8808	198.6301	179.0395	176.9028	184.0032	186.0711	207.3794	220.3189	245.4535 (64)	
Efficiency of water heater (217)m	86.6929	86.4737	86.0336	85.0935	83.3497	79.8000	79.8000	79.8000	79.8000	85.1636	86.3038	79.8000 (216)	
Fuel for water heating, kWh/month	286.1912	253.5473	270.6372	240.7714	238.3093	224.3603	221.6827	230.5805	233.1718	243.5070	255.2829	282.9612 (219)	
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (221)	
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041 (231)	
Lighting	30.8978	24.7874	22.3183	16.3513	12.6302	10.3190	11.5217	14.9764	19.4528	25.5232	28.8284	31.7566 (232)	
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-58.0045	-80.0453	-112.6319	-123.8412	-131.1631	-121.4928	-119.8712	-114.2319	-104.0603	-90.0696	-63.1011	-50.3434 (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	-38.2665	-79.7959	-157.3633	-234.6297	-308.6613	-309.6518	-306.1157	-260.0027	-191.5901	-113.6684	-50.9328	-30.3239 (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												4938.8163 (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												2981.0026 (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)												249.3632 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-3249.8585 (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												5005.3237 (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	4938.8163	0.2100	1037.1514 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2981.0026	0.2100	626.0106 (264)
Space and water heating			1663.1620 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	249.3632	0.1443	35.9908 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1168.8563	0.1351	-157.8754
PV Unit electricity exported	-2081.0022	0.1261	-262.4243
Total			-420.2996 (269)
Total CO2, kg/year			1290.7824 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.1300 (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	4938.8163	1.1300	5580.8624 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	2981.0026	1.1300	3368.5330 (278)
Space and water heating			8949.3954 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	249.3632	1.5338	382.4815 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1168.8563	1.4992	-1752.3683
PV Unit electricity exported	-2081.0022	0.4629	-963.2960
Total			-2715.6643 (283)
Total Primary energy kWh/year			6746.3135 (286)
Target Primary Energy Rate (TPER)			52.9600 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.7500 (1b)	x 2.3300 (2b)	= 153.1975 (1b) -
First floor	61.6300 (1c)	x 2.5600 (2c)	= 157.7728 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.9703 (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) =	Air changes per hour 40.0000 / (5) = 0.1286 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	4.0000 (17)
Infiltration rate	0.3286 (18)
Number of sides sheltered	2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2793 (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	0.3562	0.3492	0.3422	0.3073	0.3003	0.2654	0.2654	0.2584	0.2793	0.3003	0.3143	0.3282 (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	0.5634	0.5610	0.5585	0.5472	0.5451	0.5352	0.5352	0.5334	0.5390	0.5451	0.5494	0.5539 (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
Opening Type 1 (Uw = 1.20)			27.5900	1.1450	31.5916		(27)
Opening Type 6			4.3200	1.5000	6.4800		(26a)
225mm Beam & Block			65.7500	0.1100	7.2325		(28a)
100mm Ecobead Platinum	162.9100	31.9100	131.0000	0.2400	31.4400		(29a)
Flat Roof	3.4100		3.4100	0.1700	0.5797		(30)
500mm mineral wool	61.6300		61.6300	0.0900	5.5467		(30)
Total net area of external elements Aum(A, m ²)			293.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.8705		(33)

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

148.5300 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.7700	0.0320	0.2486
E2 Other lintels (including other steel lintels)	4.9000	0.0320	0.1568
E3 Sill	18.0500	0.0310	0.5595
E4 Jamb	37.0600	0.0360	1.3342
E4 Jamb	4.2000	0.0670	0.2814
E4 Jamb	4.2000	0.1000	0.4200
E4 Jamb	3.0000	0.0830	0.2490
E4 Jamb	3.0000	0.1000	0.3000
E5 Ground floor (normal)	34.7800	0.0590	2.0520
E6 Intermediate floor within a dwelling	31.9800	0.0060	0.1919
E10 Eaves (insulation at ceiling level)	19.0300	0.0740	1.4082
E24 Eaves (insulation at ceiling level - inverted)	3.3700	0.1500	0.5055
E12 Gable (insulation at ceiling level)	12.9500	0.0570	0.7381

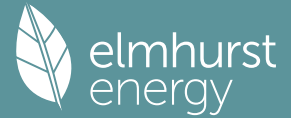
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 57.8185	Feb 57.5658	Mar 57.3180	Apr 56.1545	May 55.9368	Jun 54.9234	Jul 54.9234	Aug 54.7357	Sep 55.3137	Oct 55.9368	Nov 56.3772	Dec 56.8376	(38)
Heat transfer coeff	151.2922	151.0395	150.7918	149.6282	149.4105	148.3971	148.3971	148.2095	148.7875	149.4105	149.8509	150.3114	(39)
Average = Sum(39)m / 12 =	149.6272												
HLP													
HLP (average)	Jan 1.1877	Feb 1.1857	Mar 1.1838	Apr 1.1747	May 1.1730	Jun 1.1650	Jul 1.1650	Aug 1.1635	Sep 1.1681	Oct 1.1730	Nov 1.1764	Dec 1.1800	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

Assumed occupancy												2.8879 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.3607	30.8949	30.2391	29.0298	28.1242	27.1202	26.5778	27.2291	27.9382	29.0126	30.2468	31.2547 (42b)
Hot water usage for other uses	44.2046	42.5971	40.9897	39.3823	37.7748	36.1674	36.1674	37.7748	39.3823	40.9897	42.5971	44.2046 (42c)
Average daily hot water use (litres/day)												69.2623 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	75.5653	73.4921	71.2288	68.4120	65.8991	63.2875	62.7452	65.0039	67.3205	70.0023	72.8440	75.4593 (44)
Energy content (annual)	119.6769	104.6518	109.4760	93.6526	88.7128	77.8194	75.8849	80.4884	83.0129	94.9925	103.7796	118.1510 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	101.7254	88.9540	93.0546	79.6047	75.4059	66.1465	64.5021	68.4152	70.5610	80.7436	88.2127	100.4283 (62)
WVHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.7254	88.9540	93.0546	79.6047	75.4059	66.1465	64.5021	68.4152	70.5610	80.7436	88.2127	100.4283 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											977.7540 (64)
Electric shower(s)	58.1723	51.8320	56.5986	54.0113	55.0249	52.4884	54.2380	55.0249	54.0113	56.5986	55.5343	58.1723 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											661.7070 (64a)
Heat gains from water heating, kWh/month	39.9744	35.1965	37.4133	33.4040	32.6077	29.6587	29.6850	30.8600	31.1431	34.3356	35.9367	39.6502 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.6994	164.6315	148.6994	153.6561	148.6994	153.6561	148.6994	148.6994	153.6561	148.6994	153.6561	148.6994 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.5343	297.5906	289.8887	273.4923	252.7948	233.3421	220.3464	217.2901	224.9920	241.3884	262.0859	281.5386 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144 (71)
Water heating gains (Table 5)	53.7291	52.3758	50.2867	46.3945	43.8275	41.1927	39.8992	41.4785	43.2543	46.1499	49.9122	53.2932 (72)
Total internal gains	563.2807	580.9158	555.1928	539.8608	511.6397	494.5087	475.2630	473.7859	488.2202	502.5557	531.9720	549.8492 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
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Northeast	9.0900	11.2829	0.7100	0.7000	0.7700	35.3245 (75)
East	0.7400	19.6403	0.7100	0.7000	0.7700	5.0057 (76)
Southeast	4.0600	36.7938	0.7100	0.7000	0.7700	51.4506 (77)
South	0.7400	46.7521	0.7100	0.7000	0.7700	11.9158 (78)
Southwest	4.0900	36.7938	0.7100	0.7000	0.7700	51.8308 (79)
Northwest	8.8700	11.2829	0.7100	0.7000	0.7700	34.4695 (81)

Solar gains	189.9970	347.3015	537.6564	770.2283	957.2165	991.7343	938.9015	793.1479	617.2543	400.7224	231.8921	159.7975 (83)
Total gains	753.2777	928.2173	1092.8491	1310.0891	1468.8561	1486.2430	1414.1645	1266.9338	1105.4745	903.2781	763.8642	709.6467 (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	34.7373	34.7954	34.8526	35.1236	35.1748	35.4150	35.4150	35.4599	35.3221	35.1748	35.0714	34.9640
alpha	3.3158	3.3197	3.3235	3.3416	3.3450	3.3610	3.3610	3.3640	3.3548	3.3450	3.3381	3.3309
util living area	0.9872	0.9743	0.9475	0.8757	0.7480	0.5793	0.4426	0.5050	0.7411	0.9247	0.9775	0.9895 (86)
MIT	18.8128	19.1253	19.5865	20.1836	20.6419	20.8905	20.9665	20.9482	20.7443	20.1149	19.3558	18.7590 (87)
Th 2	19.9298	19.9314	19.9330	19.9403	19.9417	19.9481	19.9481	19.9493	19.9456	19.9417	19.9389	19.9360 (88)
util rest of house	0.9845	0.9690	0.9364	0.8497	0.6979	0.5017	0.3445	0.4023	0.6710	0.9031	0.9719	0.9872 (89)
MIT 2	17.9388	18.2488	18.7021	19.2771	19.6877	19.8888	19.9362	19.9291	19.7878	19.2273	18.4851	17.8897 (90)
Living area fraction	fLA = Living area / (4) =											0.1956 (91)
MIT	18.1097	18.4202	18.8751	19.4544	19.8743	20.0847	20.1377	20.1284	19.9748	19.4009	18.6554	18.0597 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1097	18.4202	18.8751	19.4544	19.8743	20.0847	20.1377	20.1284	19.9748	19.4009	18.6554	18.0597 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9780	0.9588	0.9223	0.8357	0.6944	0.5123	0.3628	0.4207	0.6732	0.8892	0.9625	0.9816 (94)
Useful gains	736.7178	889.9950	1007.9489	1094.8783	1020.0302	761.4666	513.0104	532.9460	744.1582	803.1701	735.2536	696.5732 (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	2089.3016	2042.0866	1866.0623	1579.2354	1221.3304	813.9188	524.9779	552.5841	874.1019	1314.9506	1731.5831	2083.2653 (97)
Space heating kWh	1006.3223	774.2056	638.4364	348.7371	149.7673	0.0000	0.0000	0.0000	0.0000	380.7647	717.3572	1031.6989 (98a)
Space heating requirement - total per year (kWh/year)												5047.2896
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	1006.3223	774.2056	638.4364	348.7371	149.7673	0.0000	0.0000	0.0000	0.0000	380.7647	717.3572	1031.6989 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5047.2896
Space heating per m2												(98c) / (4) = 39.6239 (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	1394.9329	1098.1387	1126.3918	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8355	0.8892	0.8517	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1165.4391	976.4315	959.3982	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1674.6172	1593.2226	1424.0940	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	366.6082	458.8926	345.7337	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	91.6520	114.7231	86.4334	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												292.8086 (107)
Energy for space heating												39.6239 (99)
Energy for space cooling												2.2987 (108)
Total												41.9226 (109)
Fabric Energy Efficiency (DFEE)												41.9 (109)

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1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	65.7500 (1b)	x 2.3300 (2b)	= 153.1975 (1b) -
First floor	61.6300 (1c)	x 2.5600 (2c)	= 157.7728 (1c) -
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	127.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	310.9703 (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) =	0.1286 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.3786	(18)
Number of sides sheltered	2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3460	0.3057	0.3057	0.2977	0.3218	0.3460	0.3621	0.3782 (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	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (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			4.3200	1.0000	4.3200		(26a)
TER Opening Type (Uw = 1.20)			27.5700	1.1450	31.5687		(27)
225mm Beam & Block			65.7500	0.1300	8.5475		(28a)
100mm Ecobead Platinum	162.9100	31.8900	131.0200	0.1800	23.5836		(29a)
Flat Roof	3.4100		3.4100	0.1100	0.3751		(30)
500mm mineral wool	61.6300		61.6300	0.1100	6.7793		(30)
Total net area of external elements Aum(A, m ²)			293.7000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.1742		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 148.5300 (35)

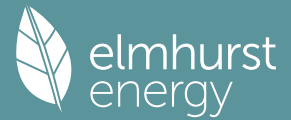
List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	7.7700	0.0500	0.3885
E2 Other lintels (including other steel lintels)	4.9000	0.0500	0.2450
E3 Sill	18.0500	0.0500	0.9025
E4 Jamb	37.0600	0.0500	1.8530
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	4.2000	0.0500	0.2100
E4 Jamb	3.0000	0.0500	0.1500
E4 Jamb	3.0000	0.0500	0.1500
E5 Ground floor (normal)	34.7800	0.1600	5.5648
E6 Intermediate floor within a dwelling	31.9800	0.0000	0.0000
E10 Eaves (insulation at ceiling level)	19.0300	0.0600	1.1418
E24 Eaves (insulation at ceiling level - inverted)	3.3700	0.2400	0.8088
E12 Gable (insulation at ceiling level)	12.9500	0.0600	0.7770
E14 Flat roof	7.1300	0.0800	0.5704
E16 Corner (normal)	19.5600	0.0900	1.7604
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			14.7322 (36)
Point Thermal bridges		(36a) =	0.0000
Total fabric heat loss		(33) + (36) + (36a) =	89.9064 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	59.9496	59.6141	59.2853	57.7408	57.4518	56.1065	56.1065	55.8574	56.6247	57.4518	58.0364	58.6476 (38)
Heat transfer coeff	149.8560	149.5206	149.1917	147.6472	147.3582	146.0129	146.0129	145.7638	146.5311	147.3582	147.9428	148.5540 (39)

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Average = Sum(39)m / 12 =

147.6458

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1764	1.1738	1.1712	1.1591	1.1568	1.1463	1.1463	1.1443	1.1503	1.1568	1.1614	1.1662 (40)
HLP (average)												1.1591
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8879 (42)
Hot water usage for mixer showers	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (42a)
Hot water usage for baths	31.3607	30.8949	30.2391	29.0298	28.1242	27.1202	26.5778	27.2291	27.9382	29.0126	30.2468	31.2547 (42b)
Hot water usage for other uses	44.2046	42.5971	40.9897	39.3823	37.7748	36.1674	36.1674	37.7748	39.3823	40.9897	42.5971	44.2046 (42c)
Average daily hot water use (litres/day)												69.2623 (43)
Daily hot water use	75.5653	73.4921	71.2288	68.4120	65.8991	63.2875	62.7452	65.0039	67.3205	70.0023	72.8440	75.4593 (44)
Energy content (annual)	119.6769	104.6518	109.4760	93.6526	88.7128	77.8194	75.8849	80.4884	83.0129	94.9925	103.7796	118.1510 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1150.2988
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (61)
Total heat required for water heating calculated for each month	101.7254	88.9540	93.0546	79.6047	75.4059	66.1465	64.5021	68.4152	70.5610	80.7436	88.2127	100.4283 (62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Output from w/h	101.7254	88.9540	93.0546	79.6047	75.4059	66.1465	64.5021	68.4152	70.5610	80.7436	88.2127	100.4283 (64)
12Total per year (kWh/year)												977.7540 (64)
Electric shower(s)	58.1723	51.8320	56.5986	54.0113	55.0249	52.4884	54.2380	55.0249	54.0113	56.5986	55.5343	58.1723 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												661.7070 (64a)
Heat gains from water heating, kWh/month	39.9744	35.1965	37.4133	33.4040	32.6077	29.6587	29.6850	30.8600	31.1431	34.3356	35.9367	39.6502 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930	144.3930 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	148.7044	164.6370	148.7044	153.6612	148.7044	153.6612	148.7044	148.7044	153.6612	148.7044	153.6612	148.7044 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	294.5343	297.5906	289.8887	273.4923	252.7948	233.3421	220.3464	217.2901	224.9920	241.3884	262.0859	281.5386 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393	37.4393 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144	-115.5144 (71)
Water heating gains (Table 5)	53.7291	52.3758	50.2867	46.3945	43.8275	41.1927	39.8992	41.4785	43.2543	46.1499	49.9122	53.2932 (72)
Total internal gains	563.2856	580.9213	555.1977	539.8659	511.6446	494.5138	475.2679	473.7908	488.2253	502.5606	531.9771	549.8541 (73)

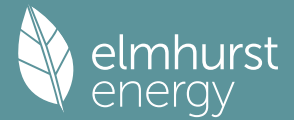
6. Solar gains

[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				9.0900	11.2829		0.6300	0.7000		0.7700	31.3443 (75)	
East				0.7400	19.6403		0.6300	0.7000		0.7700	4.4417 (76)	
Southeast				4.0600	36.7938		0.6300	0.7000		0.7700	45.6534 (77)	
South				0.7400	46.7521		0.6300	0.7000		0.7700	10.5731 (78)	
Southwest				4.0900	36.7938		0.6300	0.7000		0.7700	45.9907 (79)	
Northwest				8.8500	11.2829		0.6300	0.7000		0.7700	30.5167 (81)	

Solar gains	168.5199	308.0286	476.8224	683.0266	848.8028	879.3943	832.5530	703.3352	547.3963	355.3991	205.6767	141.7358 (83)
Total gains	731.8055	888.9498	1032.0201	1222.8925	1360.4474	1373.9081	1307.8209	1177.1261	1035.6217	857.9596	737.6538	691.5900 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.0702	35.1489	35.2264	35.5949	35.6647	35.9933	35.9933	36.0548	35.8660	35.6647	35.5238	35.3776
alpha	3.3380	3.3433	3.3484	3.3730	3.3776	3.3996	3.3996	3.4037	3.3911	3.3776	3.3683	3.3585
util living area	0.9883	0.9771	0.9543	0.8915	0.7744	0.6083	0.4679	0.5302	0.7629	0.9326	0.9795	0.9903 (86)
MIT	18.8106	19.1055	19.5480	20.1392	20.6080	20.8775	20.9622	20.9424	20.7262	20.0942	19.3522	18.7658 (87)
Th 2	19.9389	19.9410	19.9431	19.9529	19.9547	19.9632	19.9632	19.9648	19.9599	19.9547	19.9510	19.9471 (88)
util rest of house	0.9858	0.9724	0.9444	0.8679	0.7266	0.5304	0.3670	0.4258	0.6953	0.9130	0.9744	0.9882 (89)
MIT 2	17.9429	18.2362	18.6729	19.2475	19.6729	19.8957	19.9494	19.9419	19.7882	19.2185	18.4902	17.9041 (90)
Living area fraction									fLA = Living area / (4) =			0.1956 (91)
MIT	18.1126	18.4062	18.8440	19.4219	19.8557	20.0877	20.1475	20.1376	19.9716	19.3897	18.6588	18.0726 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1126	18.4062	18.8440	19.4219	19.8557	20.0877	20.1475	20.1376	19.9716	19.3897	18.6588	18.0726 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9797	0.9629	0.9312	0.8537	0.7216	0.5403	0.3856	0.4441	0.6962	0.8994	0.9656	0.9829 (94)
Useful gains	716.9311	855.9886	961.0489	1043.9448	981.7127	742.3774	504.3200	522.8026	720.9647	771.6871	712.3063	679.7475 (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	2069.9011	2019.4536	1841.6221	1553.5285	1201.8147	801.2804	517.9757	544.8013	860.3783	1295.2394	1710.0358	2060.8334 (97)
Space heating kWh	1006.6097	781.8485	655.1465	366.9003	163.7559	0.0000	0.0000	0.0000	0.0000	389.5229	718.3652	1027.5278 (98a)
Space heating requirement - total per year (kWh/year)												5109.6768
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	1006.6097	781.8485	655.1465	366.9003	163.7559	0.0000	0.0000	0.0000	0.0000	389.5229	718.3652	1027.5278 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5109.6768
Space heating per m2										(98c) / (4) =		40.1137 (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	1372.5215	1080.4956	1107.8049	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8157	0.8744	0.8352	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1119.6060	944.7687	925.1949	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1543.3112	1468.9195	1319.1187	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	305.0677	389.9682	293.0793	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	76.2669	97.4920	73.2698	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												247.0288 (107)
Energy for space heating												40.1137 (99)
Energy for space cooling												1.9393 (108)
Total												42.0530 (109)
Fabric Energy Efficiency (TFEE)												42.1 (109)