



Development at 98 Conisboro Avenue, Caversham, Reading,
RG4 7JF

Energy Statement
For

Mr & Mrs Smith
10th June 2024

The Beacon,
Dafen Business Park,
Llanelli,
Carmarthenshire,
SA14 8LQ
0845 094 1593
llanelli@melinconsultants.co.uk

Park House,
10 Park Street,
Bristol,
BS1 5HX
0845 094 1279
bristol@melinconsultants.co.uk

4th Floor,
Rex House,
4-12 Regent Street, London,
SW1Y 4RG.
0845 094 1847
london@melinconsultants.co.uk

www.melinconsultants.co.uk

Melin Consultants are accredited to provide a range of calculation, assessment and testing services.

They are members of CIBSE Low Carbon Consultants.

Melin Consultants fully check all work prior to completion and a robust audit trail exists to demonstrate accountability.

All information within this document is based on evidence provided in the form of drawings and specifications.

CPD (Continual Professional Development) records are kept, and all technical staff are required to complete a minimum 20 hours per year in training activities.

Low Carbon Consultants have the expertise and necessary qualifications to offer advice in a professional capacity on matters relating to Part L of the Building Regulations and sustainability within the construction sector.

This document contains the following information:

- Energy Statement, SAP Calculations

Project Ref: 304650 **Report Date:** 10/06/2024

Report author: David Anslow **Function:** Technical Consultant

Authorised by: Darren Baker **Function:** Senior Consultant

Contents

Contents.....	1	4.9 Renewable technologies.....	7
1. Executive Summary.....	2	5. Baseline Energy Demand and CO ₂ Emissions.....	9
1.1 Overview	2	5.1 Energy Benchmarks	9
1.2 Key Findings.....	2	5.2 Reduction in energy usage through on-site renewable technology and energy efficient measures	9
1.3 DER/TER Comparison.....	2	5.3 Regulated Energy.....	9
2. Introduction.....	3	6. Energy Statement for the Chosen Technology	10
2.1 Background	3	7. Energy Efficiency Measures included in Calculations per dwelling.	11
2.2 Policy Requirements	3	8. Conclusion.....	12
2.2.1 Reading Borough Councils Local Plan (Adopted November 2019)	3	Appendix A – Software Outputs	13
3. Site Analysis	5		
3.1 Location.....	5		
3.2 The Development.....	5		
4. Energy Efficient Design Measures	6		
4.2 Lighting.....	6		
4.3 Heating, cooling & DHW strategy	6		
4.4 Ventilation strategy.....	6		
4.5 Water use	6		
4.6 Materials	6		
4.7 Energy Efficiency Measures.....	7		
4.8 Reducing surface water run-off	7		

1. Executive Summary

1.1 Overview

The Energy Statement provides a clear assessment of the proposed development’s overall energy requirements and subsequent CO₂ emissions.

In formulating designed energy and carbon emissions Elmhurst’s SAP10 software has been used to calculate the estimated CO₂ reductions.

The Energy Strategy provides information on proposed energy efficiency measures and other carbon reductions. It also provides a summary of proposed major fabric building materials, waste management and water management. It considers how the development maintains a balance of environmental, economic, and social issues. Steps taken to promote an effective energy hierarchy are detailed.

1.2 Key Findings

The Energy Statement concludes that a minimum 19% reduction in carbon emissions can be provided from on-site renewable energy and energy efficient measures. To demonstrate this an efficient ASHP, Solar PV and MVHR has been proposed with low U values, the SAP calculations suggest that this will be more than sufficient to meet the necessary requirements.

Building Regulations England Part L (BREL) Compliance Report

Approved Document L1 2021 Edition, England assessed by Array SAP 10 program, Array

Date: Mon 10 Jun 2024 14:21:29

Project Information			
Assessed By	David Anslow	Building Type	House, Detached
OCDEA Registration	EES/027282	Assessment Date	2024-06-10

Dwelling Details			
Assessment Type	As designed	Total Floor Area	210 m ²
Site Reference	304650	Plot Reference	304650
Address	98 Conisboro Avenue, Caversham, RG4 7JF		

Client Details	
Name	Client
Company	Company
Address	Address, Town, AA11 1AA

This report covers items included within the SAP calculations. It is not a complete report of regulations compliance.

1a Target emission rate and dwelling emission rate		
Fuel for main heating system	Electricity	
Target carbon dioxide emission rate	8.28 kgCO ₂ /m ²	
Dwelling carbon dioxide emission rate	1.64 kgCO ₂ /m ²	OK
1b Target primary energy rate and dwelling primary energy		
Target primary energy	44.52 kWh _{PE} /m ²	
Dwelling primary energy	16.42 kWh _{PE} /m ²	OK
1c Target fabric energy efficiency and dwelling fabric energy efficiency		
Target fabric energy efficiency	46.1 kWh/m ²	
Dwelling fabric energy efficiency	46.1 kWh/m ²	OK

1.3 DER/TER Comparison

	Result
TER (Target Emission Rate)	1.64
DER (Dwelling Emission Rate)	8.28
% Reduction	80.19%

2. Introduction

2.1 Background

This Statement has been prepared by Melin Consultants considering *Reading Borough Councils Local Plan*.

It is intended to provide a clear and straightforward assessment of the proposed development's energy requirements and subsequent CO₂ emissions.

The *Reading Borough Councils Local Plan* requires developments to provide sufficient renewable energy generation and/or energy efficient measures to reduce the carbon emissions from the building by 19%.

This Statement assesses expected energy demand at the site, showing how carbon dioxide emissions will be reduced through designing for minimum energy use and installing on-site renewable energy.

2.2 Policy Requirements

In writing, this report the following policies and guidance have been adopted.

2.2.1 Reading Borough Councils Local Plan (Adopted November 2019)

Policies CC2 & H5 (Standards for new housing)

New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:

- a) All new build housing outside the Central Area as defined on the Proposals Map will comply with the nationally described space standard.
- b) All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations 79.
- c) All major new-build residential development should be designed to achieve zero carbon homes.
- d) All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.

-
- e) All new build housing will be accessible and adaptable in line with M4(2) of the Building Regulations unless it is built in line with M4(3) (see below).
 - f) On developments of 20 or more new build dwellings, at least 5% of dwellings will be wheelchair user dwellings in line with M4(3) of the Building Regulations. Any market homes provided to meet this requirement will be 'wheelchair adaptable' as defined in part M, whilst homes where the Council is responsible for allocating or nominating an individual may be 'wheelchair accessible'.

3. Site Analysis

3.1 Location

The proposed development is located at 98 Conisboro Avenue, Caversham, Reading. Figure 1 below highlights the area of the development.

Figure 1 - Map highlighting the location of the site and its surroundings.

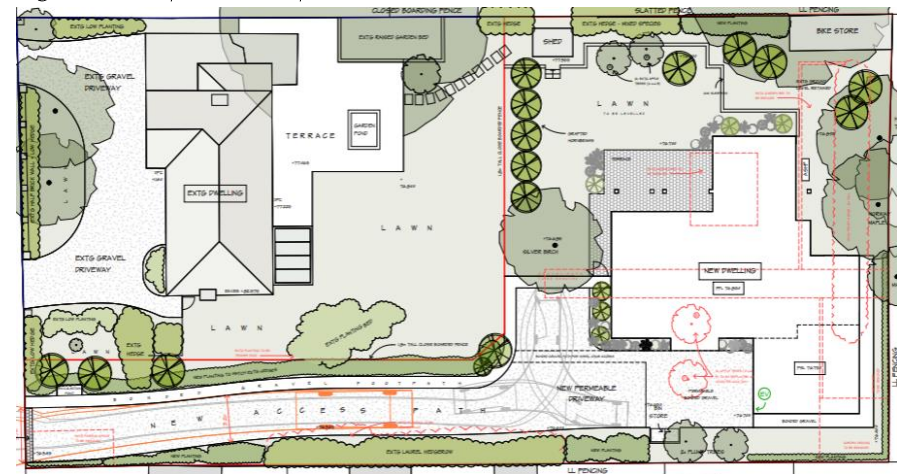


The closest train station is Reading Station, which is approximately 2.2 miles from the development site by road. This train station provides services to London, Manchester, Bristol, and many other destinations.

3.2 The Development

The proposed development will consist of the construction of a new 3-bed new dwelling with a garage.

Figure 2: Proposed site plan



4. Energy Efficient Design Measures

To supplement Reading Council's requirements for sustainable construction the design team have considered the three issues that contribute to the proposed developments overall sustainability. These are environmental, economic, and social.

4.1 Solar/Daylighting

The proposed development will make good use of glazing to all elevations to help reduce internal lighting loads.

4.2 Lighting

It has been assumed within the calculations that all internal lighting will be low energy fittings. To be classified as a low energy light fitting under the Domestic Building Services Guide the fitting must have an efficacy of 75 lumens per circuit watt or higher.

In addition, all external security and safety lighting will be fitted with daylight and movement sensors.

4.3 Heating, cooling & DHW strategy

The proposed heating and domestic hot water strategy is likely to be from an efficient air source heat pump with an efficiency of at least 430.40% along with a 250L hot water cylinder and has therefore been used for the purposes of this report.

4.4 Ventilation strategy

A Mechanical ventilation system has been specified to provide ventilation for the whole dwelling.

4.5 Water use

In order to meet Building Regulations requirements, water usage must not exceed 110 Litres/person/day in line with Enhanced Building Regulations Part G criteria. To achieve this the following fittings will be required:

- WCs – dual flush 4 (full flush), 2.6 (part flush)
- Kitchen taps – 6 litres per minute
- Basin taps – 6 litres per minute
- Baths – 180 litre capacity
- Showers – 8 litres per minute

4.6 Materials

Where possible, it is proposed that construction materials will be purchased from sources that minimise carbon emissions and/or come from sustainable sources. The environmental policy and sustainability policy for each manufacturer shall be carefully considered before orders are placed.

Where possible, timber should be sourced that has Forest Stewardship Council (FSC) or Programme for the Endorsement of

Forest Certification PEFC) certification. This is to ensure that the timber is legally and sustainably sourced.

4.7 Energy Efficiency Measures

To reduce the energy demand within the dwelling, low U values, independent psi values and low air permeability figures have been used. The U values we have used are as follows:

- Ground Floor – 0.11 W/m²K
- External Wall – 0.18 W/m²K
- Slope Roof – 0.15 W/m²K
- Solid and Glazed Doors – 1.20 W/m²K
- Windows – 1.20 W/m²K
- Thermal bridging: Reference Psi values obtained from Acceptable Construction Details (ROI) and SAP Defaults have been used.
- An air test figure of 2.70 m³/h/m² at 50Pa has been used.

4.8 Reducing surface water run-off

All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels because of climate change.

4.9 Renewable technologies

Several low carbon and renewable technologies have been considered for the proposed scheme of which Solar PV is being used with total of 5.4kWp, at 300W each panel.

A summary of the suitability of each technology is listed in the following table.

Table 3 – Summary of renewable technology

Solar PV
Solar PV lends itself to the proposed development with minimal obstruction and a significant available installation area. The electricity demand of the proposed building is not going to be significant during period of occupation and a 19% reduction in carbon emissions is achievable by using this technology on its own.
Solar thermal
The proposed development would have low to medium hot water demand which, if sized correctly, lends itself too solar thermal. It is likely that the full 19% reduction in carbon emissions could be achieved with this system alone as a large area of solar thermal panels would be required to achieve this.
Air source heat pumps
Air source technology is a potential technology that could be used on the proposed development. It would require wall or roof

mounted plant which may present visual issues. It is likely that the full 19% reduction in carbon emissions could be achieved with this system alone

Biomass

Biomass is a potential technology for the site however, space for fuel storage could be an issue within the development. Biomass boilers do not modulate as well as a conventional fuel boiler and would therefore require a constant heat demand to be sized correctly. It is unlikely that the full 19% reduction in carbon emissions could be achieved with this system alone

Ground source heat pumps

The energy demand of the proposed development would be suitable for ground source technology. Further investigation would be required into the area required for the external works and whether the Geology of the site is suitable. It is likely that the full 19% reduction in carbon emissions could be achieved with this system alone

Water source heat pump

The energy demand of the proposed development would be suitable for water source technology. Further investigation would be required into the area required for the external works and whether the Geology of the site is suitable. It is likely that the full 19% reduction in carbon emissions could be achieved with this system alone

Wind

The estimated wind speed for the location and surrounding obstructions do not lend itself to this technology.

CHP

Low electricity demand makes CHP an unviable option for this development.

5. Baseline Energy Demand and CO₂ Emissions

5.1 Energy Benchmarks

Energy performance benchmarks for the proposed development are taken from 'Energy efficiency in buildings' CIBSE Guide F (2012) and where appropriate data from relevant design team members and thermal modelling calculations.

To demonstrate how the development has reduced carbon emissions by a prescribed amount, technical calculations (SAP10) provide target CO₂ emissions (TER) for a building that is compliant with Part L 2021 (baseline buildings with conventional gas boiler), followed by a final set of calculations that provide the dwelling CO₂ emissions (DER) for a building with renewable technologies.

5.2 Reduction in energy usage through on-site renewable technology and energy efficient measures

In order to achieve the 19% reduction in carbon emissions, several renewable technologies have been considered for the proposed development (Solar Thermal, Solar PV, Wind, ASHP, GSHP, WSHP, CHP and Biomass). An ASHP, MVHR and Solar PV has been considered the most appropriate method.

5.3 Regulated Energy

All our calculations have been based on regulated energy, which includes all energy used for space and water heating, electricity for lighting and all other fixed items such as pumps and fans.

6. Energy Statement for the Chosen Technology

Based on the information provided in the above report, below is a summary of the savings:

	CO ₂ emissions (kg/m ² pa)
TER (Target Emission Rate)	8.28
DER (Dwelling Emission Rate)	1.64
Reduction in emissions from the use of renewable sources	6.64
Percentage reduction from the use of renewable sources	80.19%

7. Energy Efficiency Measures included in Calculations per dwelling.

Element or System	Part L 2021	Proposed	Achieved
Wall	0.26	Timber frame wall - 100mm Brick Work outer leaf, 50mm Low E cavity, Breather membrane, 12.5mm Cementitious board, 10mm Celotex GA4000 between studs, 40mm Celotex TB4000 Inside Studs, 12.5mm Plasterboard.	0.18
		Dormer wall and Secondary Wall - Battens, Drained and vented Cavity between battens, Breather membrane, 12.5mm Cementitious Board, 80mm Celotex GA4000 and 20mm Low E cavity between studs, 50mm Celotex GA4000 inside studs, 12.5mm Plasterboard.	0.18
Roof	0.16	Plane Roof - 400mm Rockwool roll laid between and over ceiling joists.	0.15
		Slope Roof – Ventilated cavity 50mm, 110mm XR4000 between the rafters, 60mm Celotex GA4000 under rafters, 12.5mm plasterboard.	0.15
Floor	0.18	65mm sand/cement screed, 150mm Recticel Eurothane GP, beam & block structure	0.11
Windows/Glazed Doors	1.60	Double Glazed	1.20
Roof Lights	2.20	Double Glazed	1.20
Solid Door	1.60	Solid	1.40
Ventilation		MVHR: Sentinel Kinetic Plus BS, 3.00 @ 50Pa	90.00%
Permeability	8.00		2.70
Heating System		ASHP feeding underfloor heating: Eg: Ideal heating Logic Air 87kW	430.40%
Water Heating		From main system	250L cylinder
Secondary Heating		Log Burner	65.00%
Energy efficient lighting	Efficacy = 75lm/W	Power = 10W, Efficacy = 75lm/W	
Renewables		Solar panels 5.4kWp in total, 3.6kWp on Southeast and 1.8kWp Southwest	Assumed 300W each panel from plans

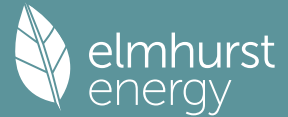
8. Conclusion

With the inclusion of energy efficient measures including low U values, Solar PV, MVHR in addition to an efficient air source heat pump, the proposed development can demonstrate a potential to reduce carbon emissions by far greater than 19% over a Part L Building Regulations 2021 target emissions rate as outlined in the table above.

Appendix A:

Software Outputs

Full SAP Calculation Printout



Property Reference	304650				Issued on Date	10/06/2024
Assessment Reference	304650	Prop Type Ref		304650		
Property	98 , Conisboro Avenue, Caversham, Reading, RG4 7JF					
SAP Rating	92 A	DER	1.64	TER	8.28	
Environmental	98 A	% DER < TER				80.19
CO ₂ Emissions (t/year)	0.3	DFEE	46.06	TFEE	46.11	
Compliance Check	See BREL	% DFEE < TFEE				0.11
% DPER < TPER	63.13	DPER	16.42	TPER	44.52	
Assessor Details	Mr. David Anslow				Assessor ID	AV54-0001
Client	304413, Mr & Mrs Ross Smith					

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	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (5)

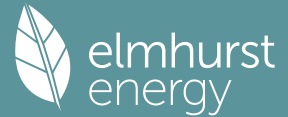
2. Ventilation rate

											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											1 * 20 =	20.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)
Number of blocked chimneys											0 * 20 =	0.0000 (6f)
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											20.0000 / (5) =	0.0355 (8)
Pressure test											Yes	
Pressure Test Method											Blower Door	
Measured/design AP50											2.7000 (17)	
Infiltration rate											0.1705 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1578 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
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												
	0.2011	0.1972	0.1932	0.1735	0.1696	0.1499	0.1499	0.1459	0.1578	0.1696	0.1775	0.1854 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.2961	0.2922	0.2882	0.2685	0.2646	0.2449	0.2449	0.2409	0.2528	0.2646	0.2725	0.2804 (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
Window (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
1/2 Glazed Door			11.4400	1.2000	13.7280		(26a)
Solid Door			6.0900	1.4000	8.5260		(26)
NE			0.8100	1.1450	0.9275		(27a)
SE			2.7600	1.1450	3.1603		(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500 (28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500 (29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500 (29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900 (29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600 (29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800 (30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600 (30)
Total net area of external elements Aum(A, m ²)			562.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	131.6967		(33)

Full SAP Calculation Printout



Internal Wall	308.6200	9.0000	2777.5800 (32c)
First Floor	69.1400	18.0000	1244.5200 (32d)
Ground Floor Ceiling	69.1400	9.0000	622.2600 (32e)

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 18558.3000 (34)
Thermal mass parameter (TMP = C_m / TFA) in $\text{kJ/m}^2\text{K}$ 88.5119 (35)

List of Thermal Bridges	Length	Psi-value	Total
K1 Element	29.0000	0.1440	4.1760
E2 Other lintels (including other steel lintels)	21.0000	0.0480	1.0080
E3 Sill	50.1000	0.0640	3.2064
E4 Jamb	58.6500	0.0510	2.9911
E5 Ground floor (normal)	40.9200	0.1300	5.3196
E6 Intermediate floor within a dwelling	41.3500	0.0750	3.1012
E11 Eaves (insulation at rafter level)	26.4600	0.0600	1.5876
E13 Gable (insulation at rafter level)	41.6000	0.0620	2.5792
E16 Corner (normal)	21.2000	-0.0040	-0.0848
E17 Corner (inverted - internal area greater than external area)	3.2000	0.2400	0.7680
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	6.9600	0.2400	1.6704
R3 Jamb of roof window			
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.0908 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 158.7875 (37)

Ventilation heat loss calculated monthly (38)m = $0.33 \times (25)\text{m} \times (5)$	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.9911	54.2587	53.5264	49.8646	49.1323	45.4705	45.4705	44.7382	46.9352	49.1323	50.5970	52.0617 (38)
Heat transfer coeff	213.7785	213.0462	212.3138	208.6521	207.9197	204.2580	204.2580	203.5256	205.7227	207.9197	209.3844	210.8491 (39)
Average = $\text{Sum}(39)\text{m} / 12 =$												208.4690
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0196	1.0161	1.0126	0.9951	0.9917	0.9742	0.9742	0.9707	0.9812	0.9917	0.9986	1.0056 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

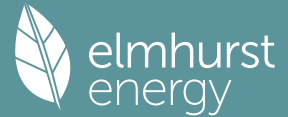
Assumed occupancy												3.0145 (42)
Hot water usage for mixer showers	102.7993	101.2544	99.0032	94.6960	91.5173	87.9726	85.9577	88.1918	90.6409	94.4469	98.8467	102.4054 (42a)
Hot water usage for baths	32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647 (42b)
Hot water usage for other uses	45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015 (42c)
Average daily hot water use (litres/day)												166.0653 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	180.5745	176.8957	172.3150	165.1086	159.3435	153.1108	150.5378	155.0968	159.9302	166.4965	173.8210	180.0716 (44)
Energy content (annual)	285.9859	251.8972	264.8417	226.0255	214.5070	188.2676	182.0625	192.0423	197.2100	225.9342	247.6399	281.9485 (45)
Distribution loss (46)m = $0.15 \times (45)\text{m}$	42.8979	37.7846	39.7263	33.9038	32.1761	28.2401	27.3094	28.8063	29.5815	33.8901	37.1460	42.2923 (46)
Water storage loss:												250.0000 (47)
Store volume												2.0900 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												1.1286 (55)
Enter (49) or (54) in (55)												
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (64)
12Total per year (kWh/year)												3444.1973 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000 (64a)
Heat gains from water heating, kWh/month	141.6895	125.8454	134.6591	120.2495	117.9228	107.6950	107.1350	110.4533	110.6683	121.7223	127.4363	140.3471 (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	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	204.8349	226.7815	204.8349	211.6628	204.8349	211.6628	204.8349	204.8349	211.6628	204.8349	211.6628	204.8349 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	380.1453	384.0900	374.1495	352.9872	326.2736	301.1666	284.3936	280.4489	290.3894	311.5517	338.2653	363.3723 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725 (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)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799 (71)
Water heating gains (Table 5)	190.4429	187.2700	180.9934	167.0131	158.4984	149.5764	143.9986	148.4587	153.7060	163.6053	176.9948	188.6386 (72)
Total internal gains	843.6406	866.3590	828.1952	799.8806	757.8244	730.6232	701.4446	701.9599	723.9757	748.2094	795.1404	825.0633 (73)

6. Solar gains

Full SAP Calculation Printout



[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				1.5000	11.2829	0.7600	0.7000	0.7700	6.2396 (75)			
Southeast				6.0400	36.7938	0.7600	0.7000	0.7700	81.9326 (77)			
Southwest				3.9000	36.7938	0.7600	0.7000	0.7700	52.9035 (79)			
Northwest				14.1900	11.2829	0.7600	0.7000	0.7700	59.0268 (81)			
Northeast				0.8100	17.4137	0.7600	0.7000	1.0000	6.7535 (82)			
Southeast				2.7600	38.2331	0.7600	0.7000	1.0000	50.5245 (82)			
Solar gains	257.3807	471.4489	728.6337	1036.0893	1277.2260	1318.0145	1249.9856	1063.3096	834.4960	543.9886	314.3996	216.2514 (83)
Total gains	1101.0213	1337.8079	1556.8289	1835.9698	2035.0503	2048.6377	1951.4302	1765.2696	1558.4717	1292.1980	1109.5400	1041.3146 (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	24.1141	24.1970	24.2805	24.7066	24.7936	25.2381	25.2381	25.3289	25.0584	24.7936	24.6202	24.4492
alpha	2.6076	2.6131	2.6187	2.6471	2.6529	2.6825	2.6825	2.6886	2.6706	2.6529	2.6413	2.6299
util living area	0.9673	0.9461	0.9094	0.8291	0.7074	0.5525	0.4276	0.4803	0.6928	0.8788	0.9501	0.9714 (86)
Living	18.8196	19.0980	19.5100	20.0508	20.4733	20.7389	20.8319	20.8118	20.6012	20.0297	19.3427	18.7880
Non living	17.4748	17.8289	18.3494	19.0277	19.5313	19.8358	19.9244	19.9121	19.6951	19.0176	18.1529	17.4424
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.8846	19.0980	19.5100	20.0508	20.4733	20.7389	20.8319	20.8118	20.6012	20.0297	19.3427	19.0974 (87)
Th 2	20.0670	20.0699	20.0728	20.0874	20.0903	20.1049	20.1049	20.1078	20.0991	20.0903	20.0845	20.0786 (88)
util rest of house	0.9629	0.9390	0.8973	0.8062	0.6682	0.4932	0.3507	0.4014	0.6383	0.8573	0.9423	0.9676 (89)
MIT 2	19.0336	17.8289	18.3494	19.0277	19.5313	19.8358	19.9244	19.9121	19.6951	19.0176	18.1529	17.9174 (90)
Living area fraction									fLA = Living area / (4) =			0.1335 (91)
MIT	19.1472	17.9984	18.5044	19.1643	19.6571	19.9564	20.0456	20.0323	19.8161	19.1527	18.3118	18.0750 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1472	17.9984	18.5044	19.1643	19.6571	19.9564	20.0456	20.0323	19.8161	19.1527	18.3118	18.0750 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9578	0.9180	0.8713	0.7791	0.6475	0.4827	0.3453	0.3944	0.6191	0.8298	0.9221	0.9564 (94)
Useful gains	1054.5266	1228.1257	1356.5428	1430.3473	1317.7653	988.8775	673.9200	696.1363	964.7794	1072.2871	1023.0664	995.9211 (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	3174.0213	2790.5601	2548.6978	2141.6741	1654.4300	1094.0794	703.7978	739.2570	1175.9235	1778.2832	2347.5709	2925.5317 (97)
Space heating kWh	1576.9040	1049.9559	886.9633	512.1553	250.4785	0.0000	0.0000	0.0000	0.0000	525.2611	953.6432	1435.6303 (98a)
Space heating requirement - total per year (kWh/year)												7190.9917
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	1576.9040	1049.9559	886.9633	512.1553	250.4785	0.0000	0.0000	0.0000	0.0000	525.2611	953.6432	1435.6303 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												7190.9917
Space heating per m2										(98c) / (4) =		34.2967 (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 %)												430.2032 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1576.9040	1049.9559	886.9633	512.1553	250.4785	0.0000	0.0000	0.0000	0.0000	525.2611	953.6432	1435.6303 (98)
Space heating efficiency (main heating system 1)	430.2032	430.2032	430.2032	430.2032	430.2032	0.0000	0.0000	0.0000	0.0000	430.2032	430.2032	430.2032 (210)
Space heating fuel (main heating system)	366.5486	244.0605	206.1731	119.0496	58.2233	0.0000	0.0000	0.0000	0.0000	122.0960	221.6727	333.7098 (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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (64)
Efficiency of water heater	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437 (216)
Fuel for water heating, kWh/month	182.8666	161.7633	171.6343	150.0159	144.8952	129.9579	127.6598	132.9613	134.7083	150.9656	161.4981	180.7219 (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	42.4475	38.3397	42.4475	41.0782	42.4475	41.0782	42.4475	42.4475	41.0782	42.4475	41.0782	42.4475 (231)
Lighting	50.6219	40.6107	36.5655	26.7894	20.6929	16.9063	18.8768	24.5368	31.8708	41.8162	47.2313	52.0288 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-107.9950	-155.1644	-226.8516	-249.7071	-258.3836	-226.9346	-224.0086	-213.8995	-191.8584	-172.9445	-117.8248	-92.0151 (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)												

Full SAP Calculation Printout



(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1671.5337	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.2437	
Water heating fuel used												1829.6481	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)													
mechanical ventilation fans (SFP = 0.7280)												499.7850	(230a)
Total electricity for the above, kWh/year												499.7850	(231)
Electricity for lighting (calculated in Appendix L)												408.5475	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2237.5873	(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												2171.9270	(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	1671.5337	0.1553	259.5235	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1829.6481	0.1410	257.9943	(264)
Space and water heating			517.5178	(265)
Pumps, fans and electric keep-hot	499.7850	0.1387	69.3263	(267)
Energy for lighting	408.5475	0.1443	58.9660	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2237.5873	0.1353	-302.7236	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-302.7236	(269)
Total CO2, kg/year			343.0866	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.6400	(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	1671.5337	1.5748	2632.2718	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1829.6481	1.5214	2783.6276	(278)
Space and water heating			5415.8994	(279)
Pumps, fans and electric keep-hot	499.7850	1.5128	756.0747	(281)
Energy for lighting	408.5475	1.5338	626.6438	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2237.5873	1.5001	-3356.5361	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-3356.5361	(283)
Total Primary energy kWh/year			3442.0818	(286)
Dwelling Primary energy Rate (DPER)			16.4200	(287)

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

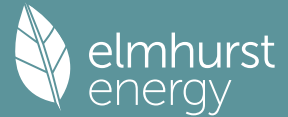
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)	
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)	
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (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)

Full SAP Calculation Printout



Number of blocked chimneys
Number of intermittent extract fans
Number of passive vents
Number of flueless gas fires

0 * 20 = 0.0000 (6f)
4 * 10 = 40.0000 (7a)
0 * 10 = 0.0000 (7b)
0 * 40 = 0.0000 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =
Pressure Test
Pressure Test Method
Measured/design AF50
Infiltration rate
Number of sides sheltered

Air changes per hour
40.0000 / (5) = 0.0711 (8)
Yes
Blower Door
5.0000 (17)
0.3211 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.2970 (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
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
Adj infilt rate												
	0.3787	0.3713	0.3638	0.3267	0.3193	0.2822	0.2822	0.2747	0.2970	0.3193	0.3341	0.3490
Effective ac	0.5717	0.5689	0.5662	0.5534	0.5510	0.5398	0.5398	0.5377	0.5441	0.5510	0.5558	0.5609

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			6.0900	1.0000	6.0900		(26)
TER Semi-glazed door			11.4400	1.0000	11.4400		(26a)
TER Opening Type (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
NE			0.8100	1.5038	1.2180		(27a)
SE			2.7600	1.5038	4.1504		(27a)
Ground Floor			140.5300	0.1300	18.2689		(28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390		(29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370		(29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518		(29a)
Secondary wall	49.4400		49.4400	0.1800	8.8992		(29a)
External Roof	135.5900	3.5700	132.0200	0.1100	14.5222		(30)
Secondary plane	32.7400		32.7400	0.1100	3.6014		(30)
Total net area of external elements Aum(A, m2)			562.1700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 126.4652		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 88.5119 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.0500	1.4500
E3 Sill	21.0000	0.0500	1.0500
E4 Jamb	50.1000	0.0500	2.5050
E5 Ground floor (normal)	58.6500	0.1600	9.3840
E6 Intermediate floor within a dwelling	40.9200	0.0000	0.0000
E11 Eaves (insulation at rafter level)	41.3500	0.0400	1.6540
E13 Gable (insulation at rafter level)	26.4600	0.0800	2.1168
E16 Corner (normal)	41.6000	0.0900	3.7440
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0900	-1.9080
R1 Head of roof window	3.2000	0.0800	0.2560
R2 Sill of roof window	3.2000	0.0600	0.1920
R3 Jamb of roof window	6.9600	0.0800	0.5568

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.0006 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 147.4658 (37)

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

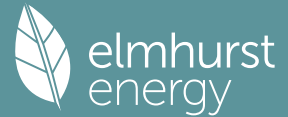
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	106.1629	105.6459	105.1392	102.7589	102.3135	100.2404	100.2404	99.8565	101.0389	102.3135	103.2145	104.1563
	253.6288	253.1118	252.6050	250.2247	249.7794	247.7062	247.7062	247.3223	248.5048	249.7794	250.6803	251.6222
Average = Sum(39)m / 12 =												250.2226

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2097	1.2072	1.2048	1.1934	1.1913	1.1814	1.1814	1.1796	1.1852	1.1913	1.1956	1.2001
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0145 (42)
Hot water usage for mixer showers													
	74.7631	73.6395	72.0023	68.8698	66.5581	63.9800	62.5147	64.1395	65.9206	68.6887	71.8885	74.4766	(42a)
Hot water usage for baths													
	32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647	(42b)
Hot water usage for other uses													
	45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015	(42c)
Average daily hot water use (litres/day)													140.2169 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	152.5384	149.2809	145.3141	139.2825	134.3842	129.1183	127.0948	131.0445	135.2100	140.7383	146.8629	152.1428	(44)
Energy conte	241.5835	212.5740	223.3424	190.6707	180.9070	158.7660	153.7102	162.2605	166.7275	190.9805	209.2331	238.2189	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m													
	36.2375	31.8861	33.5014	28.6006	27.1361	23.8149	23.0565	24.3391	25.0091	28.6471	31.3850	35.7328	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8903 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month													

Full SAP Calculation Printout



WWHRS	296.4903	262.1673	278.2492	243.8063	235.8138	211.9016	208.6170	217.1673	219.8631	245.8873	262.3687	293.1257 (62)
PV diverter	-34.1786	-30.2278	-31.6528	-26.2098	-24.4266	-20.9020	-19.5923	-20.8344	-21.6260	-25.4947	-28.8824	-33.5456 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
12Total per year (kWh/year)	262.3117	231.9395	246.5964	217.5966	211.3872	190.9996	189.0247	196.3328	198.2370	220.3926	233.4863	259.5800 (64)
Electric shower(s)												2657.8845 (64)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	124.2519	110.3554	118.1868	105.9065	104.0770	95.2982	95.0341	97.8770	97.9454	107.4265	112.0785	123.1332 (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	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	204.8349	226.7815	204.8349	211.6628	204.8349	211.6628	204.8349	204.8349	211.6628	204.8349	211.6628	204.8349	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	380.1453	384.0900	374.1495	352.9872	326.2736	301.1666	284.3936	280.4489	290.3894	311.5517	338.2653	363.3723	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	(71)
Water heating gains (Table 5)	167.0053	164.2194	158.8532	147.0924	139.8885	132.3586	127.7340	131.5552	136.0352	144.3904	155.6646	165.5016	(72)
Total internal gains	823.2030	846.3085	809.0551	782.9598	742.2145	713.4054	685.1799	685.0564	706.3049	731.9945	776.8101	804.9263	(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					1.5000	11.2829		0.6300	0.7000	0.7700		5.1723 (75)	
Southeast					6.0400	36.7938		0.6300	0.7000	0.7700		67.9178 (77)	
Southwest					3.9000	36.7938		0.6300	0.7000	0.7700		43.8542 (79)	
Northwest					14.1900	11.2829		0.6300	0.7000	0.7700		48.9301 (81)	
Northeast					0.8100	17.4137		0.6300	0.7000	1.0000		5.5983 (82)	
Southeast					2.7600	38.2331		0.6300	0.7000	1.0000		41.8822 (82)	
Solar gains		213.3550	390.8064	603.9990	858.8635	1058.7531	1092.5647	1036.1723	881.4277	691.7533	450.9380	260.6208	179.2610 (83)
Total gains		1036.5580	1237.1148	1413.0540	1641.8233	1800.9676	1805.9701	1721.3522	1566.4841	1398.0582	1182.9325	1037.4308	984.1873 (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	20.3253	20.3668	20.4077	20.6018	20.6385	20.8113	20.8113	20.8436	20.7444	20.6385	20.5644	20.4874	
alpha	2.3550	2.3578	2.3605	2.3735	2.3759	2.3874	2.3874	2.3896	2.3830	2.3759	2.3710	2.3658	
util living area	0.9723	0.9573	0.9324	0.8773	0.7871	0.6576	0.5341	0.5864	0.7724	0.9096	0.9596	0.9754 (86)	
MIT	17.7010	18.0427	18.5987	19.3680	20.0683	20.5894	20.8239	20.7735	20.3453	19.4342	18.4430	17.6489 (87)	
Th 2	19.9123	19.9143	19.9162	19.9253	19.9270	19.9349	19.9349	19.9364	19.9318	19.9270	19.9235	19.9199 (88)	
util rest of house	0.9682	0.9510	0.9219	0.8570	0.7486	0.5891	0.4327	0.4872	0.7170	0.8905	0.9526	0.9718 (89)	
MIT 2	16.0352	16.4700	17.1751	18.1420	18.9940	19.5935	19.8273	19.7886	19.3405	18.2419	16.9885	15.9728 (90)	
Living area fraction	16.2577	16.6801	17.3652	18.3057	19.1374	19.7265	19.9604	19.9202	19.4747	18.4011	17.1828	16.1966 (92)	
MIT	16.2577	16.6801	17.3652	18.3057	19.1374	19.7265	19.9604	19.9202	19.4747	18.4011	17.1828	16.1966 (93)	
Temperature adjustment												0.0000	
adjusted MIT	16.2577	16.6801	17.3652	18.3057	19.1374	19.7265	19.9604	19.9202	19.4747	18.4011	17.1828	16.1966 (93)	

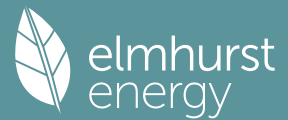
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9460	0.9224	0.8866	0.8171	0.7146	0.5739	0.4354	0.4855	0.6881	0.8526	0.9249	0.9513 (94)	
Useful gains	980.5901	1141.1530	1252.8017	1341.4828	1287.0082	1036.4712	749.4511	760.5575	962.0716	1008.6030	959.5070	936.2914 (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	3032.8131	2981.6695	2744.6076	2353.5362	1857.7169	1269.8690	832.3865	870.6135	1335.6267	1948.5506	2527.5540	3018.6185 (97)	
Space heating kWh	1526.8539	1236.8271	1109.9036	728.6784	424.6073	0.0000	0.0000	0.0000	0.0000	699.3210	1128.9938	1549.2514 (98a)	
Space heating requirement - total per year (kWh/year)												8404.4365	
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	1526.8539	1236.8271	1109.9036	728.6784	424.6073	0.0000	0.0000	0.0000	0.0000	699.3210	1128.9938	1549.2514 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												8404.4365	
Space heating per m ²												40.0841 (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)

Full SAP Calculation Printout



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	1526.8539	1236.8271	1109.9036	728.6784	424.6073	0.0000	0.0000	0.0000	0.0000	699.3210	1128.9938	1549.2514 (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)	1654.2296	1340.0077	1202.4958	789.4674	460.0296	0.0000	0.0000	0.0000	0.0000	757.6609	1223.1786	1678.4955 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	262.3117	231.9395	246.5964	217.5966	211.3872	190.9996	189.0247	196.3328	198.2370	220.3926	233.4863	259.5800 (64)
Efficiency of water heater (217)m	87.3556	87.2462	87.0160	86.5553	85.5915	79.8000	79.8000	79.8000	79.8000	86.4632	87.1163	79.8000 (216)
Fuel for water heating, kWh/month	300.2805	265.8449	283.3921	251.3961	246.9721	239.3479	236.8730	246.0311	248.4174	254.8975	268.0168	297.0511 (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	42.5607	34.1437	30.7426	22.5234	17.3977	14.2141	15.8708	20.6294	26.7956	35.1573	39.7100	43.7435 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-106.4873	-138.9777	-184.9677	-191.8914	-194.0718	-176.4469	-173.9291	-170.0296	-161.9845	-150.4356	-112.8686	-93.3985 (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	-99.2763	-202.6571	-392.1033	-574.2823	-745.9818	-745.0550	-736.5491	-629.8363	-469.9205	-285.0214	-130.8604	-79.0149 (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												9105.5651 (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												3138.5206 (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)												343.4888 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-6946.0473 (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												5727.5271 (238)

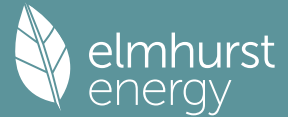
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9105.5651	0.2100	1912.1687 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3138.5206	0.2100	659.0893 (264)
Space and water heating			2571.2580 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	343.4888	0.1443	49.5761 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1855.4889	0.1363	-252.9634
PV Unit electricity exported	-5090.5585	0.1266	-644.6966
Total			-897.6600 (269)
Total CO2, kg/year			1735.1033 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			8.2800 (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	9105.5651	1.1300	10289.2885 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3138.5206	1.1300	3546.5283 (278)
Space and water heating			13835.8168 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	343.4888	1.5338	526.8546 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1855.4889	1.5040	-2790.5753
PV Unit electricity exported	-5090.5585	0.4649	-2366.6437
Total			-5157.2190 (283)
Total Primary energy kWh/year			9335.5532 (286)
Target Primary Energy Rate (TPER)			44.5200 (287)

Full SAP Calculation Printout



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	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (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) = 0.0711 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.7000 (17)
Infiltration rate	0.2061 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1906 (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	0.2430	0.2383	0.2335	0.2097	0.2049	0.1811	0.1811	0.1763	0.1906	0.2049	0.2145	0.2240 (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	0.5295	0.5284	0.5273	0.5220	0.5210	0.5164	0.5164	0.5155	0.5182	0.5210	0.5230	0.5251 (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
Window (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
1/2 Glazed Door			11.4400	1.2000	13.7280		(26a)
Solid Door			6.0900	1.4000	8.5260		(26)
NE			0.8100	1.1450	0.9275		(27a)
SE			2.7600	1.1450	3.1603		(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500 (28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500 (29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500 (29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900 (29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600 (29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800 (30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600 (30)
Total net area of external elements Aum(A, m ²)			562.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	131.6967		(33)
Internal Wall			308.6200			9.0000	2777.5800 (32c)
First Floor			69.1400			18.0000	1244.5200 (32d)
Ground Floor Ceiling			69.1400			9.0000	622.2600 (32e)

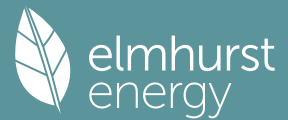
Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K
(28)...(30) + (32) + (32a)...(32e) = 18558.3000 (34)
88.5119 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	21.0000	0.0480	1.0080
E4 Jamb	50.1000	0.0640	3.2064
E5 Ground floor (normal)	58.6500	0.0510	2.9911
E6 Intermediate floor within a dwelling	40.9200	0.1300	5.3196
E11 Eaves (insulation at rafter level)	41.3500	0.0750	3.1012
E13 Gable (insulation at rafter level)	26.4600	0.0600	1.5876
E16 Corner (normal)	41.6000	0.0620	2.5792
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0040	-0.0848
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	6.9600	0.2400	1.6704
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.0908 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 158.7875 (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	98.3336	98.1206	97.9118	96.9313	96.7478	95.8938	95.8938	95.7356	96.2227	96.7478	97.1189	97.5069 (38)
Average = Sum(39)m / 12 =	257.1210	256.9081	256.6993	255.7187	255.5353	254.6812	254.6812	254.5231	255.0102	255.5353	255.9064	256.2944 (39)
												255.7178

Full SAP Calculation Printout



HLP	Jan 1.2263	Feb 1.2253	Mar 1.2243	Apr 1.2196	May 1.2187	Jun 1.2147	Jul 1.2147	Aug 1.2139	Sep 1.2162	Oct 1.2187	Nov 1.2205	Dec 1.2224 (40)
HLP (average)												1.2196
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0145 (42)
Hot water usage for mixer showers												0.0000 (42a)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Hot water usage for baths												32.2738 (42b)
32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647	
Hot water usage for other uses												45.5015 (42c)
45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015	
Average daily hot water use (litres/day)												71.2879 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
77.7753	75.6414	73.3118	70.4127	67.8262	65.1383	64.5801	66.9050	69.2894	72.0496	74.9744	77.6662	(44)
Energy content (annual)	123.1770	107.7123	112.6775	96.3914	91.3071	80.0951	78.1041	82.8423	85.4407	97.7707	106.8148	121.6064 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =	1183.9394	
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	(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	(61)
Total heat required for water heating calculated for each month												
104.7005	91.5554	95.7759	81.9327	77.6110	68.0808	66.3885	70.4160	72.6246	83.1051	90.7925	103.3655	(62)
WWHRS	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	(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	(63c)
FGHRS	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												
104.7005	91.5554	95.7759	81.9327	77.6110	68.0808	66.3885	70.4160	72.6246	83.1051	90.7925	103.3655	(64)
12Total per year (kWh/year)												1006.3485 (64)
Electric shower(s)												1006 (64)
59.8728	53.3471	58.2530	55.5902	56.6333	54.0227	55.8234	56.6333	55.5902	58.2530	57.1576	59.8728	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												681.0493 (64a)
Heat gains from water heating, kWh/month												
41.1433	36.2256	38.5072	34.3807	33.5611	30.5259	30.5530	31.7623	32.0537	35.3395	36.9875	40.8096	(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
150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
204.8349	226.7815	204.8349	211.6628	204.8349	211.6628	204.8349	204.8349	211.6628	204.8349	211.6628	204.8349	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
380.1453	384.0900	374.1495	352.9872	326.2736	301.1666	284.3936	280.4489	290.3894	311.5517	338.2653	363.3723	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	(71)
Water heating gains (Table 5)												
55.3001	53.9072	51.7570	47.7510	45.1090	42.3970	41.0658	42.6913	44.5190	47.4994	51.3716	54.8516	(72)
Total internal gains												
708.4979	732.9963	698.9589	680.6184	644.4350	623.4439	598.5118	596.1926	614.7887	632.1035	669.5171	691.2763	(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				1.5000	11.2829	0.7600	0.7000		0.7700	6.2396 (75)		
Southeast				6.0400	36.7938	0.7600	0.7000		0.7700	81.9326 (77)		
Southwest				3.9000	36.7938	0.7600	0.7000		0.7700	52.9035 (79)		
Northwest				14.1900	11.2829	0.7600	0.7000		0.7700	59.0268 (81)		
Northeast				0.8100	17.4137	0.7600	0.7000		1.0000	6.7535 (82)		
Southeast				2.7600	38.2331	0.7600	0.7000		1.0000	50.5245 (82)		
Solar gains	257.3807	471.4489	728.6337	1036.0893	1277.2260	1318.0145	1249.9856	1063.3096	834.4960	543.9886	314.3996	216.2514 (83)
Total gains	965.8785	1204.4452	1427.5926	1716.7077	1921.6609	1941.4584	1848.4974	1659.5022	1449.2847	1176.0921	983.9168	907.5276 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
20.0492	20.0659	20.0822	20.1592	20.1737	20.2413	20.2413	20.2539	20.2152	20.1737	20.1444	20.1139	
alpha	2.3366	2.3377	2.3388	2.3439	2.3449	2.3494	2.3494	2.3503	2.3477	2.3449	2.3430	2.3409
util living area												
0.9761	0.9597	0.9317	0.8700	0.7714	0.6381	0.5156	0.5727	0.7659	0.9118	0.9639	0.9793	(86)
MIT	17.5955	17.9711	18.5680	19.3698	20.0891	20.6009	20.8291	20.7751	20.3377	19.3851	18.3442	17.5236 (87)
Th 2	19.8990	19.8998	19.9006	19.9043	19.9050	19.9083	19.9083	19.9089	19.9070	19.9050	19.9036	19.9021 (88)
util rest of house												
0.9725	0.9537	0.9210	0.8486	0.7309	0.5677	0.4136	0.4719	0.7088	0.8928	0.9575	0.9761	(89)
MIT 2	16.7786	17.1508	17.7401	18.5221	19.2000	19.6535	19.8287	19.7967	19.4445	18.5525	17.5270	16.7091 (90)
Living area fraction									fLA = Living area / (4) =			0.1335 (91)

Full SAP Calculation Printout



MIT	16.8877	17.2604	17.8507	18.6353	19.3188	19.7800	19.9623	19.9273	19.5638	18.6637	17.6361	16.8179 (92)
Temperature adjustment												0.0000
adjusted MIT	16.8877	17.2604	17.8507	18.6353	19.3188	19.7800	19.9623	19.9273	19.5638	18.6637	17.6361	16.8179 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9577	0.9330	0.8941	0.8174	0.7056	0.5585	0.4191	0.4738	0.6874	0.8639	0.9380	0.9627	(94)
Useful gains	924.9856	1123.7469	1276.3629	1403.2637	1355.9084	1084.2676	774.7349	786.2939	996.1804	1016.0293	922.9309	873.7052	(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													
	3236.5519	3175.4794	2913.7067	2489.4928	1946.8625	1319.2580	856.3141	897.7894	1393.3231	2060.5532	2696.2611	3233.8867	(97)
Space heating kWh													
	1719.8054	1378.7643	1218.1838	782.0850	439.6698	0.0000	0.0000	0.0000	0.0000	777.1258	1276.7978	1755.9750	(98a)
Space heating requirement - total per year (kWh/year)												9348.4069	
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													
	1719.8054	1378.7643	1218.1838	782.0850	439.6698	0.0000	0.0000	0.0000	0.0000	777.1258	1276.7978	1755.9750	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												9348.4069	
Space heating per m2											(98c) / (4) =	44.5863	(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	0.0000	2394.0034	1884.6410	1934.3753	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6565	0.7238	0.6762	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1571.5712	1364.1099	1308.0472	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2112.4343	2010.7230	1801.6600	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	389.4214	481.0802	367.2479	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												
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	0.2500 (105)
Space cooling kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	97.3554	120.2700	91.8120	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												309.4374 (107)
Energy for space heating												44.5863 (99)
Energy for space cooling												1.4758 (108)
Total												46.0621 (109)
Fabric Energy Efficiency (DFEE)												46.1 (109)

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

1. Overall dwelling characteristics

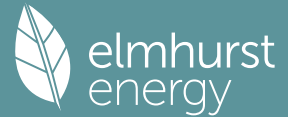
	Area (m2)	Storey height (m)	Volume (m3)	
Ground floor	140.5300 (1b)	x	2.7300 (2b)	=
First floor	69.1400 (1c)	x	2.5900 (2c)	=
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700			
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	562.7195 (5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)	
Number of open flues	0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)	
Number of blocked chimneys	0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)	
Number of passive vents	0 * 10 =	0.0000 (7b)	
Number of flueless gas fires	0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0711 (8)	
Pressure test	Yes		
Pressure Test Method	Blower Door		
Measured/design AP50	5.0000	(17)	
Infiltration rate	0.3211	(18)	
Number of sides sheltered	1	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2970 (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	0.3787	0.3713	0.3638	0.3267	0.3193	0.2822	0.2822	0.2747	0.2970	0.3193	0.3341	0.3490	(22b)

Full SAP Calculation Printout



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 0.5717 0.5689 0.5662 0.5534 0.5510 0.5398 0.5398 0.5377 0.5441 0.5510 0.5558 0.5609 (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			6.0900	1.0000	6.0900			(26)
TER Semi-glazed door			11.4400	1.0000	11.4400			(26a)
TER Opening Type (Uw = 1.20)			25.6300	1.1450	29.3473			(27)
NE			0.8100	1.5038	1.2180			(27a)
SE			2.7600	1.5038	4.1504			(27a)
Ground Floor			140.5300	0.1300	18.2689			(28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390			(29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370			(29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518			(29a)
Secondary wall	49.4400		49.4400	0.1800	8.8992			(29a)
External Roof	135.5900	3.5700	132.0200	0.1100	14.5222			(30)
Secondary plane	32.7400		32.7400	0.1100	3.6014			(30)
Total net area of external elements Aum(A, m2)			562.1700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	126.4652		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							88.5119	(35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total	
E2 Other lintels (including other steel lintels)	29.0000	0.0500	1.4500	
E3 Sill	21.0000	0.0500	1.0500	
E4 Jamb	50.1000	0.0500	2.5050	
E5 Ground floor (normal)	58.6500	0.1600	9.3840	
E6 Intermediate floor within a dwelling	40.9200	0.0000	0.0000	
E11 Eaves (insulation at rafter level)	41.3500	0.0400	1.6540	
E13 Gable (insulation at rafter level)	26.4600	0.0800	2.1168	
E16 Corner (normal)	41.6000	0.0900	3.7440	
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0900	-1.9080	
R1 Head of roof window	3.2000	0.0800	0.2560	
R2 Sill of roof window	3.2000	0.0600	0.1920	
R3 Jamb of roof window	6.9600	0.0800	0.5568	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				21.0006 (36)
Point Thermal bridges				0.0000 (36a)
Total fabric heat loss				(33) + (36) + (36a) = 147.4658 (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	106.1629	105.6459	105.1392	102.7589	102.3135	100.2404	100.2404	99.8565	101.0389	102.3135	103.2145	104.1563	(38)
Heat transfer coeff	253.6288	253.1118	252.6050	250.2247	249.7794	247.7062	247.7062	247.3223	248.5048	249.7794	250.6803	251.6222	(39)
Average = Sum(39)m / 12 =												250.2226	
HLP	1.2097	1.2072	1.2048	1.1934	1.1913	1.1814	1.1814	1.1796	1.1852	1.1913	1.1956	1.2001	(40)
HLP (average)												1.1934	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

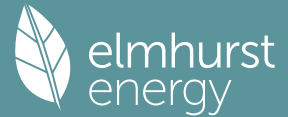
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0145 (42)
Hot water usage for mixer showers													0.0000 (42a)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Hot water usage for baths													32.1647 (42b)
32.2738 31.7945 31.1195 29.8750 28.9431 27.9098 27.3516 28.0219 28.7517 29.8574 31.1275 32.1647													
Hot water usage for other uses													45.5015 (42c)
45.5015 43.8469 42.1923 40.5377 38.8831 37.2285 37.2285 38.8831 40.5377 42.1923 43.8469 45.5015													
Average daily hot water use (litres/day)													71.2879 (43)
Daily hot water use													77.6662 (44)
77.7753 75.6414 73.3118 70.4127 67.8262 65.1383 64.5801 66.9050 69.2894 72.0496 74.9744 77.6662													
Energy conte 123.1770 107.7123 112.6775 96.3914 91.3071 80.0951 78.1041 82.8423 85.4407 97.7707 106.8148 121.6064 (45)													
Energy content (annual)													1183.9394
Distribution loss (46)m = 0.15 x (45)m													0.0000 (46)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Water storage loss:													0.0000 (56)
Total storage loss													0.0000 (56)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
If cylinder contains dedicated solar storage													0.0000 (57)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Primary loss													0.0000 (59)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Combi loss													0.0000 (61)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Total heat required for water heating calculated for each month													
104.7005 91.5554 95.7759 81.9327 77.6110 68.0808 66.3885 70.4160 72.6246 83.1051 90.7925 103.3655 (62)													
WWHRS													0.0000 (63a)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
PV diverter													0.0000 (63b)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Solar input													0.0000 (63c)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
FGHRS													0.0000 (63d)
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000													
Output from w/h													103.3655 (64)
104.7005 91.5554 95.7759 81.9327 77.6110 68.0808 66.3885 70.4160 72.6246 83.1051 90.7925 103.3655													
Total per year (kWh/year)													1006.3485 (64)
Electric shower(s)													1006 (64)
59.8728 53.3471 58.2530 55.5902 56.6333 54.0227 55.8234 56.6333 55.5902 58.2530 57.1576 59.8728 (64a)													
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													681.0493 (64a)
Heat gains from water heating, kWh/month													
41.1433 36.2256 38.5072 34.3807 33.5611 30.5259 30.5530 31.7623 32.0537 35.3395 36.9875 40.8096 (65)													

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

Metabolic gains (Table 5), Watts													
(66)m	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	150.7249	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													

Full SAP Calculation Printout



Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.8349	226.7815	204.8349	211.6628	204.8349	211.6628	204.8349	211.6628	204.8349	211.6628	204.8349	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	380.1453	384.0900	374.1495	352.9872	326.2736	301.1666	284.3936	280.4489	290.3894	311.5517	338.2653	(68)
Pumps, fans	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	38.0725	(69)
Losses e.g. evaporation (negative values) (Table 5)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Water heating gains (Table 5)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	(71)
Total internal gains	55.3001	53.9072	51.7570	47.7510	45.1090	42.3970	41.0658	42.6913	44.5190	47.4994	51.3716	(72)
	708.4979	732.9963	698.9589	680.6184	644.4350	623.4439	598.5118	596.1926	614.7887	632.1035	669.5171	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					1.5000	11.2829		0.6300	0.7000	0.7700		5.1723 (75)				
Southeast					6.0400	36.7938		0.6300	0.7000	0.7700		67.9178 (77)				
Southwest					3.9000	36.7938		0.6300	0.7000	0.7700		43.8542 (79)				
Northwest					14.1900	11.2829		0.6300	0.7000	0.7700		48.9301 (81)				
Northeast					0.8100	17.4137		0.6300	0.7000	1.0000		5.5983 (82)				
Southeast					2.7600	38.2331		0.6300	0.7000	1.0000		41.8822 (82)				
Solar gains					213.3550	390.8064	603.9990	858.8635	1058.7531	1092.5647	1036.1723	881.4277	691.7533	450.9380	260.6208	179.2610 (83)
Total gains					921.8529	1123.8026	1302.9579	1539.4819	1703.1881	1716.0085	1634.6841	1477.6203	1306.5420	1083.0414	930.1379	870.5373 (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	20.3253	20.3668	20.4077	20.6018	20.6385	20.8113	20.8113	20.8436	20.7444	20.6385	20.5644	20.4874
alpha	2.3550	2.3578	2.3605	2.3735	2.3759	2.3874	2.3874	2.3896	2.3830	2.3759	2.3710	2.3658
util living area	0.9783	0.9648	0.9420	0.8901	0.8034	0.6764	0.5537	0.6086	0.7929	0.9230	0.9676	0.9810 (86)
MIT	17.5926	17.9403	18.5064	19.2958	20.0178	20.5615	20.8091	20.7536	20.3001	19.3557	18.3449	17.5402 (87)
Th 2	19.9123	19.9143	19.9162	19.9253	19.9270	19.9349	19.9349	19.9364	19.9318	19.9270	19.9235	19.9199 (88)
util rest of house	0.9750	0.9595	0.9328	0.8713	0.7666	0.6085	0.4510	0.5089	0.7400	0.9062	0.9619	0.9782 (89)
MIT 2	16.7838	17.1296	17.6907	18.4679	19.1560	19.6486	19.8431	19.8096	19.4343	18.5397	17.5401	16.7363 (90)
Living area fraction	fLA = Living area / (4) = 0.1335 (91)											
MIT	16.8918	17.2379	17.7996	18.5785	19.2710	19.7705	19.9721	19.9357	19.5499	18.6487	17.6476	16.8437 (92)
Temperature adjustment	0.0000											
adjusted MIT	16.8918	17.2379	17.7996	18.5785	19.2710	19.7705	19.9721	19.9357	19.5499	18.6487	17.6476	16.8437 (93)

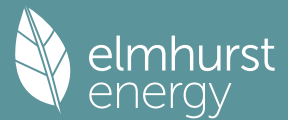
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	886.1512	1057.0143	1183.1399	1295.1246	1259.7609	1023.8043	743.6366	751.8239	936.7194	951.8794	877.9551	840.6869 (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	3193.6399	3122.8637	2854.3352	2421.8009	1891.0911	1280.7576	835.2875	874.4462	1354.3319	2010.3919	2644.0749	3181.4244 (97)
Space heating kWh	1716.7716	1388.2508	1243.3693	811.2069	469.7096	0.0000	0.0000	0.0000	0.0000	787.5333	1271.6063	1741.5087 (98a)
Space heating requirement - total per year (kWh/year)	9429.9565											
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	1716.7716	1388.2508	1243.3693	811.2069	469.7096	0.0000	0.0000	0.0000	0.0000	787.5333	1271.6063	1741.5087 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	9429.9565											
Space heating per m2	(98c) / (4) = 44.9752 (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	2328.4386	1833.0261	1879.6496	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6220	0.6923	0.6456	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1448.3061	1268.9853	1213.4905	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1858.2122	1769.6360	1596.5979	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	295.1325	372.4841	285.0319	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	73.7831	93.1210	71.2580	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement	238.1621 (107)											
Energy for space heating	44.9752 (99)											
Energy for space cooling	1.1359 (108)											
Total	46.1111 (109)											
Fabric Energy Efficiency (TFEE)	46.1 (109)											

Full SAP Calculation Printout



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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (5)

2. Ventilation rate

Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	1 * 20 =	20.0000 (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) =	20.0000 / (5) =	0.0355 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	2.7000	(17)
Infiltration rate	0.1705	(18)
Number of sides sheltered	1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1578 (21)
Wind speed	Jan 5.1000 Feb 5.0000 Mar 4.9000 Apr 4.4000 May 4.3000 Jun 3.8000 Jul 3.8000 Aug 3.7000 Sep 4.0000 Oct 4.3000 Nov 4.5000 Dec 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	0.2011 0.1972 0.1932 0.1735 0.1696 0.1499 0.1499 0.1459 0.1578 0.1696 0.1775 0.1854	(22b)
Balanced mechanical ventilation with heat recovery		
If mechanical ventilation		0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)		0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =		81.0000 (23c)
Effective ac	0.2961 0.2922 0.2882 0.2685 0.2646 0.2449 0.2449 0.2409 0.2528 0.2646 0.2725 0.2804	(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
Window (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
1/2 Glazed Door			11.4400	1.2000	13.7280		(26a)
Solid Door			6.0900	1.4000	8.5260		(26)
NE			0.8100	1.1450	0.9275		(27a)
SE			2.7600	1.1450	3.1603		(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500 (28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500 (29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500 (29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900 (29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600 (29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800 (30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600 (30)
Total net area of external elements Aum(A, m ²)			562.1700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		131.6967		(33)
Internal Wall			308.6200			9.0000	2777.5800 (32c)
First Floor			69.1400			18.0000	1244.5200 (32d)
Ground Floor Ceiling			69.1400			9.0000	622.2600 (32e)

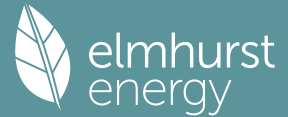
Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18558.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 88.5119 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	21.0000	0.0480	1.0080
E4 Jamb	50.1000	0.0640	3.2064
E5 Ground floor (normal)	58.6500	0.0510	2.9911
E6 Intermediate floor within a dwelling	40.9200	0.1300	5.3196
E11 Eaves (insulation at rafter level)	41.3500	0.0750	3.1012
E13 Gable (insulation at rafter level)	26.4600	0.0600	1.5876
E16 Corner (normal)	41.6000	0.0620	2.5792
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0040	-0.0848
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	6.9600	0.2400	1.6704
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.0908 (36)
Point Thermal bridges			0.0000 (36a) =
Total fabric heat loss			(33) + (36) + (36a) = 158.7875 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.9911	Feb 54.2587	Mar 53.5264	Apr 49.8646	May 49.1323	Jun 45.4705	Jul 45.4705	Aug 44.7382	Sep 46.9352	Oct 49.1323	Nov 50.5970	Dec 52.0617 (38)
Heat transfer coeff	213.7785	213.0462	212.3138	208.6521	207.9197	204.2580	204.2580	203.5256	205.7227	207.9197	209.3844	210.8491 (39)
Average = Sum(39)m / 12 =												208.4690

Full SAP Calculation Printout



HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0196	1.0161	1.0126	0.9951	0.9917	0.9742	0.9742	0.9707	0.9812	0.9917	0.9986	1.0056 (40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	0.9943 31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0145 (42)
Hot water usage for mixer showers												
102.7993	101.2544	99.0032	94.6960	91.5173	87.9726	85.9577	88.1918	90.6409	94.4469	98.8467	102.4054 (42a)	
Hot water usage for baths												
32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647 (42b)	
Hot water usage for other uses												
45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015 (42c)	
Average daily hot water use (litres/day)												166.0653 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	180.5745	176.8957	172.3150	165.1086	159.3435	153.1108	150.5378	155.0968	159.9302	166.4965	173.8210	180.0716 (44)
Energy content (annual)	285.9859	251.8972	264.8417	226.0255	214.5070	188.2676	182.0625	192.0423	197.2100	225.9342	247.6399	281.9485 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 2758.3623
42.8979	37.7846	39.7263	33.9038	32.1761	28.2401	27.3094	28.8063	29.5815	33.8901	37.1460	42.2923 (46)	
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0900 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1286 (55)
Total storage loss												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)	
If cylinder contains dedicated solar storage												
34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624 (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 (61)	
Total heat required for water heating calculated for each month												
344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (62)	
WWHRS	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 (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 (63c)	
FGHRS	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												
344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (64)	
								Total per year (kWh/year) = Sum(64)m =				3444.1973 (64)
Electric shower(s)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)	
								Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =				0.0000 (64a)
Heat gains from water heating, kWh/month												
141.6895	125.8454	134.6591	120.2495	117.9228	107.6950	107.1350	110.4533	110.6683	121.7223	127.4363	140.3471 (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	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8341	51.3678	41.7751	31.6264	23.6411	19.9588	21.5662	28.0326	37.6253	47.7739	55.7592	59.4415 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	567.3811	573.2687	558.4321	526.8466	486.9755	449.5024	424.4680	418.5804	433.4171	465.0026	504.8736	542.3467 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015 (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)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799 (71)
Water heating gains (Table 5)	190.4429	187.2700	180.9934	167.0131	158.4984	149.5764	143.9986	148.4587	153.7060	163.6053	176.9948	188.6386 (72)
Total internal gains	932.0496	928.2979	897.5920	841.8776	785.5065	735.4290	706.4243	711.4631	741.1398	792.7732	854.0191	906.8183 (73)

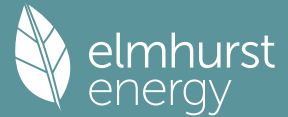
6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	1.5000	11.2829	0.7600	0.7000	0.7700	6.2396 (75)						
Southeast	6.0400	36.7938	0.7600	0.7000	0.7700	81.9326 (77)						
Southwest	3.9000	36.7938	0.7600	0.7000	0.7700	52.9035 (79)						
Northwest	14.1900	11.2829	0.7600	0.7000	0.7700	59.0268 (81)						
Northeast	0.8100	17.4137	0.7600	0.7000	1.0000	6.7535 (82)						
Southeast	2.7600	38.2331	0.7600	0.7000	1.0000	50.5245 (82)						
Solar gains	257.3807	471.4489	728.6337	1036.0893	1277.2260	1318.0145	1249.9856	1063.3096	834.4960	543.9886	314.3996	216.2514 (83)
Total gains	1189.4302	1399.7468	1626.2256	1877.9668	2062.7324	2053.4436	1956.4099	1774.7727	1575.6358	1336.7619	1168.4187	1123.0696 (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	24.1141	24.1970	24.2805	24.7066	24.7936	25.2381	25.2381	25.3289	25.0584	24.7936	24.6202	24.4492
alpha	2.6076	2.6131	2.6187	2.6471	2.6529	2.6825	2.6825	2.6886	2.6706	2.6529	2.6413	2.6299
util living area	0.9613	0.9408	0.9015	0.8227	0.7024	0.5516	0.4267	0.4782	0.6886	0.8712	0.9443	0.9662 (86)
Living	18.8841	19.1401	19.5515	20.0697	20.4809	20.7395	20.8322	20.8126	20.6056	20.0537	19.3835	18.8488
Non living	17.5563	17.8817	18.4004	19.0499	19.5395	19.8363	19.9246	19.9127	19.6995	19.0461	18.2038	17.5194

Full SAP Calculation Printout



24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.9176	19.1401	19.5515	20.0697	20.4809	20.7395	20.8322	20.8126	20.6056	20.0537	19.3835	19.1497 (87)
Th 2	20.0670	20.0699	20.0728	20.0874	20.0903	20.1049	20.1049	20.1078	20.0991	20.0903	20.0845	20.0786 (88)
util rest of house												
	0.9562	0.9331	0.8886	0.7993	0.6630	0.4923	0.3499	0.3996	0.6339	0.8487	0.9358	0.9617 (89)
MIT 2	19.0661	17.8817	18.4004	19.0499	19.5395	19.8363	19.9246	19.9127	19.6995	19.0461	18.2038	17.9806 (90)
Living area fraction										FLA = Living area / (4) =		0.1335 (91)
MIT	19.1798	18.0497	18.5541	19.1861	19.6652	19.9569	20.0458	20.0328	19.8205	19.1807	18.3614	18.1367 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1798	18.0497	18.5541	19.1861	19.6652	19.9569	20.0458	20.0328	19.8205	19.1807	18.3614	18.1367 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9504	0.9111	0.8621	0.7723	0.6426	0.4818	0.3446	0.3926	0.6150	0.8211	0.9144	0.9492	(94)
Useful gains	1130.4626	1275.3496	1401.9339	1450.3729	1325.5453	989.4375	674.1232	696.7234	968.9968	1097.5968	1068.4059	1066.0396	(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	3180.9800	2801.5015	2559.2561	2146.2199	1656.1181	1094.1937	703.8390	739.3765	1176.8311	1784.0900	2357.9579	2938.5404	(97)
Space heating kWh	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406	(98a)
Space heating requirement - total per year (kWh/year)												6991.5318	
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	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6991.5318	
Space heating per m2										(98c) / (4) =		33.3454	(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 %)	430.2032	(206)
Efficiency of main space heating system 2 (in %)	0.0000	(207)
Efficiency of secondary/supplementary heating system, %	65.0000	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406	(98)
Space heating efficiency (main heating system 1)	430.2032	430.2032	430.2032	430.2032	430.2032	0.0000	0.0000	0.0000	0.0000	430.2032	430.2032	430.2032	(210)
Space heating fuel (main heating system)	354.6196	238.3929	200.1491	116.4589	57.1698	0.0000	0.0000	0.0000	0.0000	118.7232	215.8230	323.8332	(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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(64)
Efficiency of water heater (217)m	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	(216)
Fuel for water heating, kWh/month	182.8666	161.7633	171.6343	150.0159	144.8952	129.9579	127.6598	132.9613	134.7083	150.9656	161.4981	180.7219	(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	42.4475	38.3397	42.4475	41.0782	42.4475	41.0782	42.4475	42.4475	41.0782	42.4475	41.0782	42.4475	(231)
Lighting	50.6219	40.6107	36.5655	26.7894	20.6929	16.9063	18.8768	24.5368	31.8708	41.8162	47.2313	52.0288	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-107.7594	-154.8788	-226.2630	-249.2684	-258.1331	-226.9346	-224.0086	-213.8995	-191.8584	-172.6499	-117.6273	-91.8525	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1625.1696	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.2437	
Water heating fuel used												1829.6481	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)		
mechanical ventilation fans (SFP = 0.7280)	499.7850	(230a)
Total electricity for the above, kWh/year	499.7850	(231)
Electricity for lighting (calculated in Appendix L)	408.5475	(232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2235.1336	(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	2128.0166	(238)

Full SAP Calculation Printout



10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1625.1696	16.4900	267.9905 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1829.6481	16.4900	301.7090 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	499.7850	16.4900	82.4145 (249)
Energy for lighting	408.5475	16.4900	67.3695 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2235.1336	16.4900	-368.5735
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-368.5735 (252)
Total energy cost			350.9099 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.4960 (257)
SAP value		91.9591
SAP rating (Section 12)		92 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1625.1696	0.1552	252.2891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1829.6481	0.1410	257.9943 (264)
Space and water heating			510.2835 (265)
Pumps, fans and electric keep-hot	499.7850	0.1387	69.3263 (267)
Energy for lighting	408.5475	0.1443	58.9660 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2235.1336	0.1353	-302.3572
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-302.3572 (269)
Total CO2, kg/year			336.2186 (272)
CO2 emissions per m2			1.6000 (273)
EI value			98.2309
EI rating			98 (274)
EI band			A

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

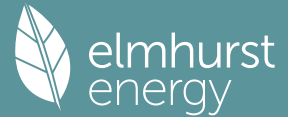
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	562.7195 (5)

2. Ventilation rate

	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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) =	20.0000 / (5) = 0.0355 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.7000 (17)
Infiltration rate	0.1705 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1578 (21)

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000	(22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750	(22a)
Adj infilt rate													
	0.1814	0.1735	0.1735	0.1617	0.1617	0.1459	0.1459	0.1380	0.1499	0.1656	0.1578	0.1696	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation													
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)													0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													0.5000 (23b)
													81.0000 (23c)
Effective ac	0.2764	0.2685	0.2685	0.2567	0.2567	0.2409	0.2409	0.2330	0.2449	0.2606	0.2528	0.2646	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Window (Uw = 1.20)			25.6300	1.1450	29.3473			(27)
1/2 Glazed Door			11.4400	1.2000	13.7280			(26a)
Solid Door			6.0900	1.4000	8.5260			(26)
NE			0.8100	1.1450	0.9275			(27a)
SE			2.7600	1.1450	3.1603			(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500	(28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500	(29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500	(29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900	(29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600	(29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800	(30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600	(30)
Total net area of external elements Aum(A, m2)			562.1700					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	131.6967		(33)
Internal Wall			308.6200			9.0000	2777.5800	(32c)
First Floor			69.1400			18.0000	1244.5200	(32d)
Ground Floor Ceiling			69.1400			9.0000	622.2600	(32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K
(28)...(30) + (32) + (32a)...(32e) = 18558.3000 (34)
88.5119 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	21.0000	0.0480	1.0080
E4 Jamb	50.1000	0.0640	3.2064
E5 Ground floor (normal)	58.6500	0.0510	2.9911
E6 Intermediate floor within a dwelling	40.9200	0.1300	5.3196
E11 Eaves (insulation at rafter level)	41.3500	0.0750	3.1012
E13 Gable (insulation at rafter level)	26.4600	0.0600	1.5876
E16 Corner (normal)	41.6000	0.0620	2.5792
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0040	-0.0848
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	6.9600	0.2400	1.6704

Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Point Thermal bridges
(36a) = 27.0908 (36)
Total fabric heat loss
(33) + (36) + (36a) = 158.7875 (37)

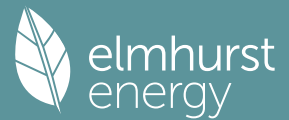
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	51.3293	49.8646	49.8646	47.6676	47.6676	44.7382	44.7382	43.2735	45.4705	48.3999	46.9352	49.1323	(38)
Average = Sum(39)m / 12 =	210.1168	208.6521	208.6521	206.4550	206.4550	203.5256	203.5256	202.0609	204.2580	207.1874	205.7227	207.9197	(39)
													206.2109

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0021	0.9951	0.9951	0.9847	0.9847	0.9707	0.9707	0.9637	0.9742	0.9882	0.9812	0.9917	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0145 (42)
Hot water usage for mixer showers													
	102.7993	101.2544	99.0032	94.6960	91.5173	87.9726	85.9577	88.1918	90.6409	94.4469	98.8467	102.4054	(42a)
Hot water usage for baths	32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647	(42b)
Hot water usage for other uses	45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015	(42c)
Average daily hot water use (litres/day)													166.0653 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	180.5745	176.8957	172.3150	165.1086	159.3435	153.1108	150.5378	155.0968	159.9302	166.4965	173.8210	180.0716	(44)
Energy content (annual)	285.9859	251.8972	264.8417	226.0255	214.5070	188.2676	182.0625	192.0423	197.2100	225.9342	247.6399	281.9485	(45)
Distribution loss (46)m = 0.15 x (45)m													
	42.8979	37.7846	39.7263	33.9038	32.1761	28.2401	27.3094	28.8063	29.5815	33.8901	37.1460	42.2923	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1286 (55)
Total storage loss													
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage													
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(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													
	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(64)

Full SAP Calculation Printout



Total per year (kWh/year) = Sum(64)m =											3444.1973 (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 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	141.6895	125.8454	134.6591	120.2495	117.9228	107.6950	107.1350	110.4533	110.6683	121.7223	127.4363 (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	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8341	51.3678	41.7751	31.6264	23.6411	19.9588	21.5662	28.0326	37.6253	47.7739	55.7592	59.4415 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	567.3811	573.2687	558.4321	526.8466	486.9755	449.5024	424.4680	418.5804	433.4171	465.0026	504.8736	542.3467 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015 (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)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799 (71)
Water heating gains (Table 5)	190.4429	187.2700	180.9934	167.0131	158.4984	149.5764	143.9986	148.4587	153.7060	163.6053	176.9948	188.6386 (72)
Total internal gains	932.0496	928.2979	897.5920	841.8776	785.5065	735.4290	706.4243	711.4631	741.1398	792.7732	854.0191	906.8183 (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					1.5000	13.7804		0.7600	0.7000	0.7700		7.6208 (75)	
Southeast					6.0400	43.0593		0.7600	0.7000	0.7700		95.8845 (77)	
Southwest					3.9000	43.0593		0.7600	0.7000	0.7700		61.9122 (79)	
Northwest					14.1900	13.7804		0.7600	0.7000	0.7700		72.0924 (81)	
Northeast					0.8100	21.4042		0.7600	0.7000	1.0000		8.3011 (82)	
Southeast					2.7600	45.8318		0.7600	0.7000	1.0000		60.5662 (82)	

Solar gains	306.3773	491.9889	751.2122	1100.1403	1317.2599	1439.0452	1350.7417	1175.7522	920.9517	602.3982	359.7798	258.6928 (83)	
Total gains	1238.4268	1420.2868	1648.8042	1942.0178	2102.7663	2174.4743	2057.1661	1887.2153	1662.0915	1395.1715	1213.7989	1165.5110 (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	24.5344	24.7066	24.7066	24.9695	24.9695	25.3289	25.3289	25.5125	25.2381	24.8813	25.0584	24.7936
alpha	2.6356	2.6471	2.6471	2.6646	2.6646	2.6886	2.6886	2.7008	2.6825	2.6588	2.6706	2.6529
util living area	0.9552	0.9349	0.8906	0.7955	0.6632	0.4758	0.3501	0.3848	0.6363	0.8481	0.9342	0.9605 (86)
Living	19.0247	19.2645	19.6763	20.1926	20.5669	20.7977	20.8585	20.8515	20.6765	20.1612	19.5284	18.9948
Non living	17.7444	18.0508	18.5666	19.2046	19.6415	19.8946	19.9473	19.9491	19.7786	19.1785	18.3965	17.7128
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.9895	19.2645	19.6763	20.1926	20.5669	20.7977	20.8585	20.8515	20.6765	20.1612	19.5284	19.2753 (87)
Th 2	20.0816	20.0874	20.0874	20.0961	20.0961	20.1078	20.1078	20.1137	20.1049	20.0932	20.0991	20.0903 (88)
util rest of house	0.9492	0.9264	0.8761	0.7689	0.6193	0.4120	0.2713	0.3026	0.5760	0.8217	0.9241	0.9553 (89)
MIT 2	19.1498	18.0508	18.5666	19.2046	19.6415	19.8946	19.9473	19.9491	19.7786	19.1785	18.3965	18.1412 (90)
Living area fraction									fLA = Living area / (4) =			0.1335 (91)
MIT	19.2620	18.2129	18.7148	19.3365	19.7651	20.0152	20.0690	20.0696	19.8985	19.3097	18.5476	18.2926 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2620	18.2129	18.7148	19.3365	19.7651	20.0152	20.0690	20.0696	19.8985	19.3097	18.5476	18.2926 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9430	0.9039	0.8494	0.7432	0.6017	0.4051	0.2678	0.2983	0.5606	0.7942	0.9013	0.9417 (94)
Useful gains	1167.8302	1283.7543	1400.4805	1443.2390	1265.2546	880.8135	550.8641	563.0348	931.8298	1108.0123	1094.0191	1097.5127 (95)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000 (96)
Heat loss rate W	3059.7109	2694.3016	2444.3225	2030.7987	1520.5543	939.3154	563.5614	579.8303	1082.2603	1700.9492	2252.1799	2826.1788 (97)
Space heating kWh	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276 (98a)
Space heating requirement - total per year (kWh/year)												6306.1999
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	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												6306.1999
Space heating per m2										(98c) / (4) =		30.0768 (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 %)	430.1516 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)
Efficiency of secondary/supplementary heating system, %	65.0000 (208)

Full SAP Calculation Printout



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276	(98)
Space heating efficiency (main heating system 1)	430.1516	430.1516	430.1516	430.1516	430.1516	0.0000	0.0000	0.0000	0.0000	430.1516	430.1516	430.1516	(210)
Space heating fuel (main heating system)	327.2240	220.3613	180.5453	98.3474	44.1572	0.0000	0.0000	0.0000	0.0000	102.5557	193.8562	298.9940	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(64)
Efficiency of water heater (217)m	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	(216)
Fuel for water heating, kWh/month	182.8708	161.7670	171.6382	150.0193	144.8985	129.9609	127.6627	132.9644	134.7115	150.9691	161.5018	180.7260	(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	42.4475	38.3397	42.4475	41.0782	42.4475	41.0782	42.4475	42.4475	41.0782	42.4475	41.0782	42.4475	(231)
Lighting	50.6219	40.6107	36.5655	26.7894	20.6929	16.9063	18.8768	24.5368	31.8708	41.8162	47.2313	52.0288	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-123.9899	-159.4729	-228.8574	-253.1596	-257.6375	-233.2118	-229.4815	-221.9425	-200.8611	-183.0370	-130.0749	-106.4961	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity) (233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity) (234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity) (235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation) (235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1466.0412	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.2394	
Water heating fuel used												1829.6902	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)													
mechanical ventilation fans (SFP = 0.7280)												499.7850	(230a)
Total electricity for the above, kWh/year												499.7850	(231)
Electricity for lighting (calculated in Appendix L)												408.5475	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2328.2223	(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												1875.8416	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1466.0412	26.0600	382.0503	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1829.6902	26.0600	476.8173	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	499.7850	26.0600	130.2440	(249)
Energy for lighting	408.5475	26.0600	106.4675	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2328.2223	26.0600	-606.7347	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-606.7347	(252)
Total energy cost			488.8443	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1466.0412	0.1556	228.0671	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1829.6902	0.1410	258.0003	(264)
Space and water heating			486.0673	(265)
Pumps, fans and electric keep-hot	499.7850	0.1387	69.3263	(267)
Energy for lighting	408.5475	0.1443	58.9660	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2328.2223	0.1356	-315.6649	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-315.6649	(269)
Total CO2, kg/year			298.6948	(272)

Full SAP Calculation Printout



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	1466.0412	1.5759	2310.3349 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1829.6902	1.5214	2783.6918 (278)
Space and water heating			5094.0267 (279)
Pumps, fans and electric keep-hot	499.7850	1.5128	756.0747 (281)
Energy for lighting	408.5475	1.5338	626.6438 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2328.2223	1.5011	-3495.0055
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-3495.0055 (283)
Total Primary energy kWh/year			2981.7397 (286)

SAP 10 EPC IMPROVEMENTS

304650

Current energy efficiency rating: A 92
Current environmental impact rating: A 98

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

Recommended measures:	SAP change	Cost change	CO2 change
(none)			
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 66	-31 kg (10.5%)

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

Potential energy efficiency rating: A 92
Potential environmental impact rating: A 98

Fuel prices for cost data on this page from database revision number 547 TEST (31 May 2024)
Recommendation texts revision number 6.1 (11 Jun 2019)

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

	Current	Potential	Saving
Electricity	£1096	£1096	£0
Space heating	£512	£512	£0
Water heating	£477	£477	£0
Lighting	£106	£106	£0
Generated (PV)	-£607	-£607	£0
Total cost of fuels	£489	£489	£0
Total cost of uses	£488	£488	£0
Delivered energy	9 kWh/m²	9 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.3 tonnes	0.3 tonnes	0.0 tonnes
CO2 emissions per m²	1 kg/m²	1 kg/m²	0 kg/m²
Primary energy	14 kWh/m²	14 kWh/m²	0 kWh/m²

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

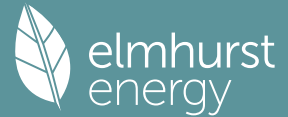
1. Overall dwelling characteristics

	Area (m²)	Storey height (m)	Volume (m³)
Ground floor	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (5)

2. Ventilation rate

	m³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (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)

Full SAP Calculation Printout



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

Air changes per hour
20.0000 / (5) = 0.0355 (8)
Yes
Blower Door
2.7000 (17)
0.1705 (18)
1 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) = 0.1578 (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	0.2011	0.1972	0.1932	0.1735	0.1696	0.1499	0.1499	0.1459	0.1578	0.1696	0.1775	0.1854 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2961	0.2922	0.2882	0.2685	0.2646	0.2449	0.2449	0.2409	0.2528	0.2646	0.2725	0.2804 (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
Window (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
1/2 Glazed Door			11.4400	1.2000	13.7280		(26a)
Solid Door			6.0900	1.4000	8.5260		(26)
NE			0.8100	1.1450	0.9275		(27a)
SE			2.7600	1.1450	3.1603		(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500 (28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500 (29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500 (29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900 (29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600 (29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800 (30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600 (30)
Total net area of external elements Aum(A, m ²)			562.1700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	131.6967		(33)
Internal Wall			308.6200			9.0000	2777.5800 (32c)
First Floor			69.1400			18.0000	1244.5200 (32d)
Ground Floor Ceiling			69.1400			9.0000	622.2600 (32e)

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

(28)...(30) + (32) + (32a)...(32e) = 18558.3000 (34)
88.5119 (35)

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	29.0000	0.1440	4.1760
E3 Sill	21.0000	0.0480	1.0080
E4 Jamb	50.1000	0.0640	3.2064
E5 Ground floor (normal)	58.6500	0.0510	2.9911
E6 Intermediate floor within a dwelling	40.9200	0.1300	5.3196
E11 Eaves (insulation at rafter level)	41.3500	0.0750	3.1012
E13 Gable (insulation at rafter level)	26.4600	0.0600	1.5876
E16 Corner (normal)	41.6000	0.0620	2.5792
E17 Corner (inverted - internal area greater than external area)	21.2000	-0.0040	-0.0848
R1 Head of roof window	3.2000	0.2400	0.7680
R2 Sill of roof window	3.2000	0.2400	0.7680
R3 Jamb of roof window	6.9600	0.2400	1.6704
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			27.0908 (36)
Point Thermal bridges			(36a) = 0.0000
Total fabric heat loss			(33) + (36) + (36a) = 158.7875 (37)

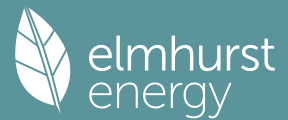
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)
(38)m
Heat transfer coeff
Average = Sum(39)m / 12 =

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0196	1.0161	1.0126	0.9951	0.9917	0.9742	0.9742	0.9707	0.9812	0.9917	0.9986	Dec 1.0056 (40)
HLP (average)												0.9943
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy 3.0145 (42)
Hot water usage for mixer showers
Hot water usage for baths
Hot water usage for other uses
Average daily hot water use (litres/day)
Daily hot water use
Energy conte
Energy content (annual)
Distribution loss (46)m = 0.15 x (45)m
Water storage loss:
Store volume
a) If manufacturer declared loss factor is known (kWh/day):
Temperature factor from Table 2b
Enter (49) or (54) in (55)
Total storage loss

Full SAP Calculation Printout



If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (56)
	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866 (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												
WWHRS	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (62)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63a)
Solar input	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000 (63b)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63c)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63d)
Electric shower(s)	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (64)
	Total per year (kWh/year) = Sum(64)m =											3444.1973 (64)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
	141.6895	125.8454	134.6591	120.2495	117.9228	107.6950	107.1350	110.4533	110.6683	121.7223	127.4363	140.3471 (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	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8341	51.3678	41.7751	31.6264	23.6411	19.9588	21.5662	28.0326	37.6253	47.7739	55.7592	59.4415 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	567.3811	573.2687	558.4321	526.8466	486.9755	449.5024	424.4680	418.5804	433.4171	465.0026	504.8736	542.3467 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015 (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)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799 (71)
Water heating gains (Table 5)	190.4429	187.2700	180.9934	167.0131	158.4984	149.5764	143.9986	148.4587	153.7060	163.6053	176.9948	188.6386 (72)
Total internal gains	932.0496	928.2979	897.5920	841.8776	785.5065	735.4290	706.4243	711.4631	741.1398	792.7732	854.0191	906.8183 (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					1.5000	11.2829		0.7600	0.7000	0.7700		6.2396 (75)	
Southeast					6.0400	36.7938		0.7600	0.7000	0.7700		81.9326 (77)	
Southwest					3.9000	36.7938		0.7600	0.7000	0.7700		52.9035 (79)	
Northwest					14.1900	11.2829		0.7600	0.7000	0.7700		59.0268 (81)	
Northeast					0.8100	17.4137		0.7600	0.7000	1.0000		6.7535 (82)	
Southeast					2.7600	38.2331		0.7600	0.7000	1.0000		50.5245 (82)	
Solar gains		257.3807	471.4489	728.6337	1036.0893	1277.2260	1318.0145	1249.9856	1063.3096	834.4960	543.9886	314.3996	216.2514 (83)
Total gains		1189.4302	1399.7468	1626.2256	1877.9668	2062.7324	2053.4436	1956.4099	1774.7727	1575.6358	1336.7619	1168.4187	1123.0696 (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	24.1141	24.1970	24.2805	24.7066	24.7936	25.2381	25.2381	25.3289	25.0584	24.7936	24.6202	24.4492
alpha	2.6076	2.6131	2.6187	2.6471	2.6529	2.6825	2.6825	2.6886	2.6706	2.6529	2.6413	2.6299
util living area	0.9613	0.9408	0.9015	0.8227	0.7024	0.5516	0.4267	0.4782	0.6886	0.8712	0.9443	0.9662 (86)
Living	18.8841	19.1401	19.5515	20.0697	20.4809	20.7395	20.8322	20.8126	20.6056	20.0537	19.3835	18.8488
Non living	17.5563	17.8817	18.4004	19.0499	19.5395	19.8363	19.9246	19.9127	19.6995	19.0461	18.2038	17.5194
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	3		0	0	0	0	0	0	0	0	0	0
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10
MIT	19.9176	19.1401	19.5515	20.0697	20.4809	20.7395	20.8322	20.8126	20.6056	20.0537	19.3835	19.1497 (87)
Th 2	20.0670	20.0699	20.0728	20.0874	20.0903	20.1049	20.1049	20.1078	20.0991	20.0903	20.0845	20.0786 (88)
util rest of house	0.9562	0.9331	0.8886	0.7993	0.6630	0.4923	0.3499	0.3996	0.6339	0.8487	0.9358	0.9617 (89)
MIT 2	19.0661	17.8817	18.4004	19.0499	19.5395	19.8363	19.9246	19.9127	19.6995	19.0461	18.2038	17.9806 (90)
Living area fraction	fLA = Living area / (4) = 0.1335 (91)											
MIT	19.1798	18.0497	18.5541	19.1861	19.6652	19.9569	20.0458	20.0328	19.8205	19.1807	18.3614	18.1367 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1798	18.0497	18.5541	19.1861	19.6652	19.9569	20.0458	20.0328	19.8205	19.1807	18.3614	18.1367 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9504	0.9111	0.8621	0.7723	0.6426	0.4818	0.3446	0.3926	0.6150	0.8211	0.9144	0.9492 (94)
Ext temp.	1130.4626	1275.3496	1401.9339	1450.3729	1325.5453	989.4375	674.1232	696.7234	968.9968	1097.5968	1068.4059	1066.0396 (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	3180.9800	2801.5015	2559.2561	2146.2199	1656.1181	1094.1937	703.8390	739.3765	1176.8311	1784.0900	2357.9579	2938.5404 (97)
Space heating requirement - total per year (kWh/year)	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406 (98a)
Solar heating kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (98b)
Solar heating contribution - total per year (kWh/year)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Space heating kWh	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406 (98c)

Full SAP Calculation Printout



Space heating per m2

(98c) / (4) = 33.3454 (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 %)												430.2032 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1525.5850	1025.5741	861.0477	501.0099	245.9462	0.0000	0.0000	0.0000	0.0000	510.7510	928.4774	1393.1406 (98)
Space heating efficiency (main heating system 1)	430.2032	430.2032	430.2032	430.2032	430.2032	0.0000	0.0000	0.0000	0.0000	430.2032	430.2032	430.2032 (210)
Space heating fuel (main heating system)	354.6196	238.3929	200.1491	116.4589	57.1698	0.0000	0.0000	0.0000	0.0000	118.7232	215.8230	323.8332 (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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975 (64)
Efficiency of water heater (217)m	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437	188.2437 (216)
Fuel for water heating, kWh/month	182.8666	161.7633	171.6343	150.0159	144.8952	129.9579	127.6598	132.9613	134.7083	150.9656	161.4981	180.7219 (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	42.4475	38.3397	42.4475	41.0782	42.4475	41.0782	42.4475	42.4475	41.0782	42.4475	41.0782	42.4475 (231)
Lighting	50.6219	40.6107	36.5655	26.7894	20.6929	16.9063	18.8768	24.5368	31.8708	41.8162	47.2313	52.0288 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-107.7594	-154.8788	-226.2630	-249.2684	-258.1331	-226.9346	-224.0086	-213.8995	-191.8584	-172.6499	-117.6273	-91.8525 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)												
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)												
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)												
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												1625.1696 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												188.2437
Water heating fuel used												1829.6481 (219)
Space cooling fuel												0.0000 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)												
mechanical ventilation fans (SFP = 0.7280)												499.7850 (230a)
Total electricity for the above, kWh/year												499.7850 (231)
Electricity for lighting (calculated in Appendix L)												408.5475 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2235.1336 (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												2128.0166 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1625.1696	16.4900	267.9905 (240)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1829.6481	16.4900	301.7090 (247)
Energy for instantaneous electric shower(s)	0.0000	16.4900	0.0000 (247a)
Pumps, fans and electric keep-hot	499.7850	16.4900	82.4145 (249)
Energy for lighting	408.5475	16.4900	67.3695 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2235.1336	16.4900	-368.5735
PV Unit electricity exported	0.0000	5.5900	0.0000
Total			-368.5735 (252)
Total energy cost			350.9099 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.3600 (256)
Energy cost factor (ECF)		0.4960 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	91.9591
SAP rating (Section 12)		92 (258)
SAP band		A

Full SAP Calculation Printout



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	1625.1696	0.1552	252.2891 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1829.6481	0.1410	257.9943 (264)
Space and water heating			510.2835 (265)
Pumps, fans and electric keep-hot	499.7850	0.1387	69.3263 (267)
Energy for lighting	408.5475	0.1443	58.9660 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2235.1336	0.1353	-302.3572
PV Unit electricity exported	0.0000	0.0000	0.0000
Total			-302.3572 (269)
Total CO2, kg/year			336.2186 (272)
CO2 emissions per m2			1.6000 (273)
EI value			98.2309
EI rating			98 (274)
EI band			A

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

1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	140.5300 (1b)	x 2.7300 (2b)	= 383.6469 (1b) - (3b)
First floor	69.1400 (1c)	x 2.5900 (2c)	= 179.0726 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	209.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 562.7195 (5)

2. Ventilation rate

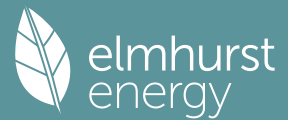
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	1 * 20 = 20.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
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) =	20.0000 / (5) = 0.0355 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	2.7000 (17)
Infiltration rate	0.1705 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.1578 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.6000	4.4000	4.4000	4.1000	4.1000	3.7000	3.7000	3.5000	3.8000	4.2000	4.0000	4.3000 (22)
Wind factor	1.1500	1.1000	1.1000	1.0250	1.0250	0.9250	0.9250	0.8750	0.9500	1.0500	1.0000	1.0750 (22a)
Adj infilt rate	0.1814	0.1735	0.1735	0.1617	0.1617	0.1459	0.1459	0.1380	0.1499	0.1656	0.1578	0.1696 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												0.5000 (23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												81.0000 (23c)
Effective ac	0.2764	0.2685	0.2685	0.2567	0.2567	0.2409	0.2409	0.2330	0.2449	0.2606	0.2528	0.2646 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Window (Uw = 1.20)			25.6300	1.1450	29.3473		(27)
1/2 Glazed Door			11.4400	1.2000	13.7280		(26a)
Solid Door			6.0900	1.4000	8.5260		(26)
NE			0.8100	1.1450	0.9275		(27a)
SE			2.7600	1.1450	3.1603		(27a)
Ground Floor			140.5300	0.1100	15.4583	75.0000	10539.7500 (28a)
External Wall	184.8200	41.2700	143.5500	0.1800	25.8390	9.0000	1291.9500 (29a)
Garage wall	16.5400	1.8900	14.6500	0.1800	2.6370	9.0000	131.8500 (29a)
Dormer wall	2.5100		2.5100	0.1800	0.4518	9.0000	22.5900 (29a)
Secondary wall	49.4400		49.4400	0.1700	8.4048	9.0000	444.9600 (29a)
External Roof	135.5900	3.5700	132.0200	0.1500	19.8030	9.0000	1188.1800 (30)
Secondary plane	32.7400		32.7400	0.1043	3.4136	9.0000	294.6600 (30)
Total net area of external elements Aum(A, m2)			562.1700				(31)

Full SAP Calculation Printout



Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	131.6967		(33)
Internal Wall	308.6200		9.0000	2777.5800 (32c)
First Floor	69.1400		18.0000	1244.5200 (32d)
Ground Floor Ceiling	69.1400		9.0000	622.2600 (32e)

Heat capacity Cm = Sum (A x k)	(28)...(30) + (32) + (32a)...(32e) =	18558.3000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		88.5119 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	29.0000	0.1440	4.1760	
E2 Other lintels (including other steel lintels)	21.0000	0.0480	1.0080	
E3 Sill	50.1000	0.0640	3.2064	
E4 Jamb	58.6500	0.0510	2.9911	
E5 Ground floor (normal)	40.9200	0.1300	5.3196	
E6 Intermediate floor within a dwelling	41.3500	0.0750	3.1012	
E11 Eaves (insulation at rafter level)	26.4600	0.0600	1.5876	
E13 Gable (insulation at rafter level)	41.6000	0.0620	2.5792	
E16 Corner (normal)	21.2000	-0.0040	-0.0848	
E17 Corner (inverted - internal area greater than external area)	3.2000	0.2400	0.7680	
R1 Head of roof window	3.2000	0.2400	0.7680	
R2 Sill of roof window	6.9600	0.2400	1.6704	
R3 Jamb of roof window				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				27.0908 (36)
Point Thermal bridges			(36a) =	0.0000
Total fabric heat loss			(33) + (36) + (36a) =	158.7875 (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	51.3293	49.8646	49.8646	47.6676	47.6676	44.7382	44.7382	43.2735	45.4705	48.3999	46.9352	49.1323	(38)
Heat transfer coeff	210.1168	208.6521	208.6521	206.4550	206.4550	203.5256	203.5256	202.0609	204.2580	207.1874	205.7227	207.9197	(39)
Average = Sum(39)m / 12 =												206.2109	
HLP	1.0021	0.9951	0.9951	0.9847	0.9847	0.9707	0.9707	0.9637	0.9742	0.9882	0.9812	0.9917	(40)
HLP (average)												0.9835	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

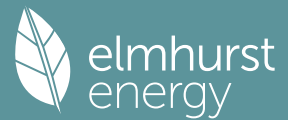
Assumed occupancy													3.0145 (42)
Hot water usage for mixer showers	102.7993	101.2544	99.0032	94.6960	91.5173	87.9726	85.9577	88.1918	90.6409	94.4469	98.8467	102.4054	(42a)
Hot water usage for baths	32.2738	31.7945	31.1195	29.8750	28.9431	27.9098	27.3516	28.0219	28.7517	29.8574	31.1275	32.1647	(42b)
Hot water usage for other uses	45.5015	43.8469	42.1923	40.5377	38.8831	37.2285	37.2285	38.8831	40.5377	42.1923	43.8469	45.5015	(42c)
Average daily hot water use (litres/day)												166.0653	(43)
Daily hot water use	180.5745	176.8957	172.3150	165.1086	159.3435	153.1108	150.5378	155.0968	159.9302	166.4965	173.8210	180.0716	(44)
Energy conte	285.9859	251.8972	264.8417	226.0255	214.5070	188.2676	182.0625	192.0423	197.2100	225.9342	247.6399	281.9485	(45)
Energy content (annual)												2758.3623	
Distribution loss (46)m = 0.15 x (45)m	42.8979	37.7846	39.7263	33.9038	32.1761	28.2401	27.3094	28.8063	29.5815	33.8901	37.1460	42.2923	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0900 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1286 (55)
Total storage loss	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(56)
If cylinder contains dedicated solar storage	34.9866	31.6008	34.9866	33.8580	34.9866	33.8580	34.9866	34.9866	33.8580	34.9866	33.8580	34.9866	(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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												0.0000	(64a)
Heat gains from water heating, kWh/month	141.6895	125.8454	134.6591	120.2495	117.9228	107.6950	107.1350	110.4533	110.6683	121.7223	127.4363	140.3471	(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	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	180.8699	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8341	51.3678	41.7751	31.6264	23.6411	19.9588	21.5662	28.0326	37.6253	47.7739	55.7592	59.4415	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	567.3811	573.2687	558.4321	526.8466	486.9755	449.5024	424.4680	418.5804	433.4171	465.0026	504.8736	542.3467	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	56.1015	(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)	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	-120.5799	(71)
Water heating gains (Table 5)	190.4429	187.2700	180.9934	167.0131	158.4984	149.5764	143.9986	148.4587	153.7060	163.6053	176.9948	188.6386	(72)
Total internal gains	932.0496	928.2979	897.5920	841.8776	785.5065	735.4290	706.4243	711.4631	741.1398	792.7732	854.0191	906.8183	(73)

6. Solar gains

Full SAP Calculation Printout



[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				1.5000	13.7804	0.7600		0.7000		0.7700		7.6208 (75)	
Southeast				6.0400	43.0593	0.7600		0.7000		0.7700		95.8845 (77)	
Southwest				3.9000	43.0593	0.7600		0.7000		0.7700		61.9122 (79)	
Northwest				14.1900	13.7804	0.7600		0.7000		0.7700		72.0924 (81)	
Northeast				0.8100	21.4042	0.7600		0.7000		1.0000		8.3011 (82)	
Southeast				2.7600	45.8318	0.7600		0.7000		1.0000		60.5662 (82)	
Solar gains	306.3773	491.9889	751.2122	1100.1403	1317.2599	1439.0452	1350.7417	1175.7522	920.9517	602.3982	359.7798	258.6928	(83)
Total gains	1238.4268	1420.2868	1648.8042	1942.0178	2102.7663	2174.4743	2057.1661	1887.2153	1662.0915	1395.1715	1213.7989	1165.5110	(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	24.5344	24.7066	24.7066	24.9695	24.9695	25.3289	25.3289	25.5125	25.2381	24.8813	25.0584	24.7936	
alpha	2.6356	2.6471	2.6471	2.6646	2.6646	2.6886	2.6886	2.7008	2.6825	2.6588	2.6706	2.6529	
util living area	0.9552	0.9349	0.8906	0.7955	0.6632	0.4758	0.3501	0.3848	0.6363	0.8481	0.9342	0.9605	(86)
Living	19.0247	19.2645	19.6763	20.1926	20.5669	20.7977	20.8585	20.8515	20.6765	20.1612	19.5284	18.9948	
Non living	17.7444	18.0508	18.5666	19.2046	19.6415	19.8946	19.9473	19.9491	19.7786	19.1785	18.3965	17.7128	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	19.9895	19.2645	19.6763	20.1926	20.5669	20.7977	20.8585	20.8515	20.6765	20.1612	19.5284	19.2753	(87)
Th 2	20.0816	20.0874	20.0874	20.0961	20.0961	20.1078	20.1078	20.1137	20.1049	20.0932	20.0991	20.0903	(88)
util rest of house	0.9492	0.9264	0.8761	0.7689	0.6193	0.4120	0.2713	0.3026	0.5760	0.8217	0.9241	0.9553	(89)
MIT 2	19.1498	18.0508	18.5666	19.2046	19.6415	19.8946	19.9473	19.9491	19.7786	19.1785	18.3965	18.1412	(90)
Living area fraction	fLA = Living area / (4) = 0.1335 (91)												
MIT	19.2620	18.2129	18.7148	19.3365	19.7651	20.0152	20.0690	20.0696	19.8985	19.3097	18.5476	18.2926	(92)
Temperature adjustment	0.0000												
adjusted MIT	19.2620	18.2129	18.7148	19.3365	19.7651	20.0152	20.0690	20.0696	19.8985	19.3097	18.5476	18.2926	(93)
8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9430	0.9039	0.8494	0.7432	0.6017	0.4051	0.2678	0.2983	0.5606	0.7942	0.9013	0.9417	(94)
Ext temp.	4.7000	5.3000	7.0000	9.5000	12.4000	15.4000	17.3000	17.2000	14.6000	11.1000	7.6000	4.7000	(96)
Heat loss rate W	3059.7109	2694.3016	2444.3225	2030.7987	1520.5543	939.3154	563.5614	579.8303	1082.2603	1700.9492	2252.1799	2826.1788	(97)
Space heating kWh	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276	(98a)
Space heating requirement - total per year (kWh/year)	6306.1999												
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	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)	6306.1999												
Space heating per m2	(98c) / (4) = 30.0768 (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 %)													430.1516 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1407.5592	947.8878	776.6185	423.0430	189.9430	0.0000	0.0000	0.0000	0.0000	441.1450	833.8758	1286.1276	(98)
Space heating efficiency (main heating system 1)	430.1516	430.1516	430.1516	430.1516	430.1516	0.0000	0.0000	0.0000	0.0000	430.1516	430.1516	430.1516	(210)
Space heating fuel (main heating system)	327.2240	220.3613	180.5453	98.3474	44.1572	0.0000	0.0000	0.0000	0.0000	102.5557	193.8562	298.9940	(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	344.2349	304.5092	323.0907	282.3955	272.7560	244.6376	240.3115	250.2913	253.5800	284.1832	304.0099	340.1975	(64)
Water heating requirement	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	188.2394	(216)
Efficiency of water heater (217)m	182.8708	161.7670	171.6382	150.0193	144.8985	129.9609	127.6627	132.9644	134.7115	150.9691	161.5018	180.7260	(217)
Fuel for water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(219)
Space cooling fuel requirement (221)m	42.4475	38.3397	42.4475	41.0782	42.4475	41.0782	42.4475	42.4475	41.0782	42.4475	41.0782	42.4475	(221)
Pumps and Fa	50.6219	40.6107	36.5655	26.7894	20.6929	16.9063	18.8768	24.5368	31.8708	41.8162	47.2313	52.0288	(232)
Lighting	-123.9899	-159.4729	-228.8574	-253.1596	-257.6375	-233.2118	-229.4815	-221.9425	-200.8611	-183.0370	-130.0749	-106.4961	(233a)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
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	(235a)
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) (235c)m													

Full SAP Calculation Printout



(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												1466.0412	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												188.2394	
Water heating fuel used												1829.6902	(219)
Space cooling fuel												0.0000	(221)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.7280)													
mechanical ventilation fans (SFP = 0.7280)												499.7850	(230a)
Total electricity for the above, kWh/year												499.7850	(231)
Electricity for lighting (calculated in Appendix L)												408.5475	(232)

Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2328.2223	(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												1875.8416	(238)

10a. Fuel costs - using BEDF prices (547)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1466.0412	26.0600	382.0503	(240)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1829.6902	26.0600	476.8173	(247)
Energy for instantaneous electric shower(s)	0.0000	26.0600	0.0000	(247a)
Pumps, fans and electric keep-hot	499.7850	26.0600	130.2440	(249)
Energy for lighting	408.5475	26.0600	106.4675	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2328.2223	26.0600	-606.7347	
PV Unit electricity exported	0.0000	5.8100	0.0000	
Total			-606.7347	(252)
Total energy cost			488.8443	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1466.0412	0.1556	228.0671	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1829.6902	0.1410	258.0003	(264)
Space and water heating			486.0673	(265)
Pumps, fans and electric keep-hot	499.7850	0.1387	69.3263	(267)
Energy for lighting	408.5475	0.1443	58.9660	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2328.2223	0.1356	-315.6649	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-315.6649	(269)
Total CO2, kg/year			298.6948	(272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	1466.0412	1.5759	2310.3349	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1829.6902	1.5214	2783.6918	(278)
Space and water heating			5094.0267	(279)
Pumps, fans and electric keep-hot	499.7850	1.5128	756.0747	(281)
Energy for lighting	408.5475	1.5338	626.6438	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2328.2223	1.5011	-3495.0055	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-3495.0055	(283)
Total Primary energy kWh/year			2981.7397	(286)