

Energy Statement

Collins Court,
Cascade Avenue,
London

Job number: S10559

Date: January 2023

BASE ENERGY LIVERPOOL
Head Office

T: +44 (0)151 933 0328

E: north@baseenergy.co.uk

BASE ENERGY LONDON
London Office

T: +44 (0)203 286 2016

E: south@baseenergy.co.uk

BASE ENERGY SHEFFIELD
Sheffield Office

T: +44 (0)114 303 4986

E: north@baseenergy.co.uk

Revision	Issue Date	Author	Checked	Description
0	10/01/2023	CT	PK	First Issue
1	20/12/2023	CT	PK	Second Issue
2	05/03/2024	CT	PK	Third Issue

This report has been produced by **Base Energy Services Limited** and is provided for use of the client and solely in relation to the named project. It should neither be reproduced in part nor in whole nor distributed to third parties without the express written consent of both Base Energy Services Limited and the client.

This document and any calculations herein have been produced based on information supplied by the client and their agents and design team. Any amendments to the technical specification on which this report is based may invalidate the results.

Contents

1	Executive Summary	3
2	Existing and Proposed Development	5
3	Planning Policy	6
4	Methodology	7
5	Baseline Energy & CO2	8
6	Low Carbon Design – Fabric First – Be Lean	9
7	Low Carbon Technology Review & Recommendations	11
8	Low Carbon Technology – Renewable Energy Generation - Be Green	15
9	Zero Carbon Standard Summary	16
10	Conclusion.....	17
11	Appendix 1 – Baseline/Be Lean SAP Worksheets.....	18
12	Appendix 2 - Be Green SAP Worksheets.....	19

1 Executive Summary

This report has been produced by Base Energy on behalf of ROK Enterprises One and in support of the planning application for the development named as Collins Court comprising nine Dwellings, consisting of two runs of four new build terraces and one converted tennis pavilion to a detached bungalow, falling under the requirements of Haringey council.

The report sets out the design approach with regards to energy, carbon dioxide emissions, and sustainability in order to ensure the development complies with:

- National Planning Policy
- The London Plan Policy SI 2: Minimising greenhouse gas emissions
- The Haringey Council Local Plan Policy SP4: Working Towards A Low Carbon Haringey

The above policies require:

- A minimum 35% CO2 reduction over Part L1 2021 with an aim to achieve zero Carbon
- A 10% CO2 reduction over Part L1 2021 through energy saving measures
- A 20% CO2 reduction from on-site renewable technology sources

The design of the development will incorporate energy efficient building fabric and services in addition to low carbon technology:

- Thermal specification exceeding Part L 2021 notional U-values
- A design which limits air permeability, targeting 4
- A design which limits thermal bridging, when the final construction has been decided these will be assessed
- Energy saving building services including low energy lighting, heating controls and heat recovery ventilation

Low carbon Air Source Heat Pumps and Solar PV Panels 3.2kWp for all the dwellings, totalling 28.8kWp for the total development and 5kw batteries in all plots. The flat roof space to all the new build dwellings has been maximised so a maximum 17% CO2 reduction of Part L1 2021 can be achieved.

This results in an 84% CO2 reduction Part L1 2021. With a total of 10% CO2 reduction through energy saving measures and 74% from the installation of on-site renewable and low carbon technology.

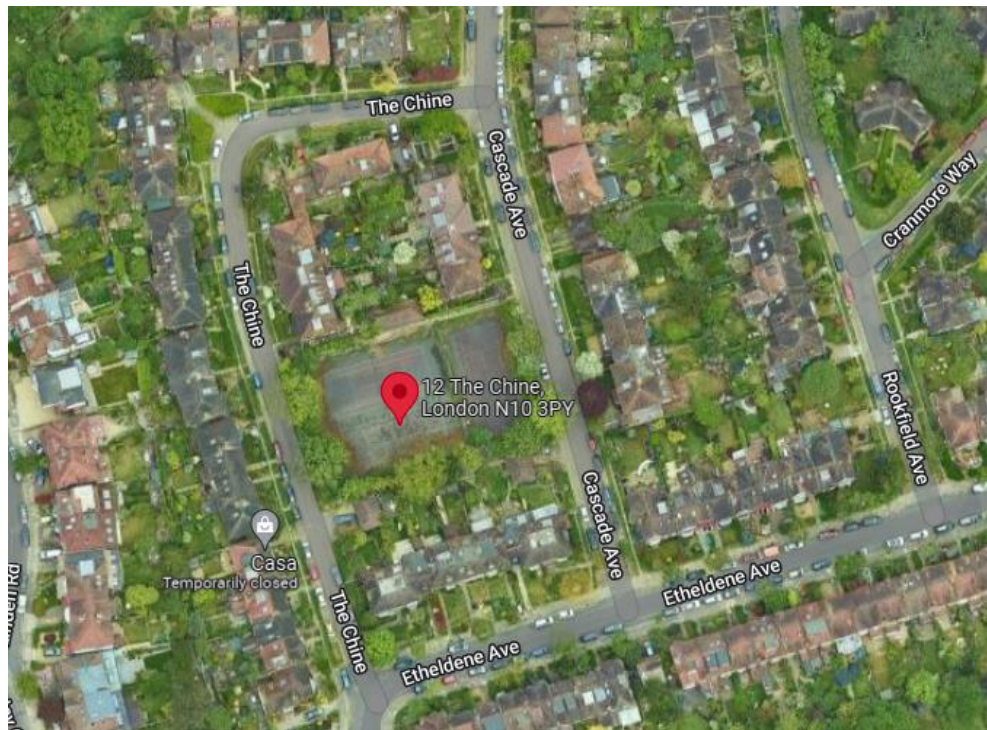
2 Existing and Proposed Development

The development site is located on land at Collins Court, Cascade Avenue in London.

The development proposals are for nine dwellings comprising of two runs of four new build terraces and one converted tennis pavilion to a detached bungalow. The development proposals constitute a minor development.

Aspects of the site location, shape, and surroundings (in particular the adjacent buildings), along with any other requirements of planning, use type, and scale will naturally constrain the development proposals in terms of the layout, positioning, and orientation of the proposed development. Subsequently, these constraints will impact on the feasibility of certain renewable technologies (as discussed in Section 4 of this report).

Figure 2.1: Site Location and proposals



3 Planning Policy

National Planning Policy Framework 2021

The NPPF was updated in July 2021 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The Haringey Local Planning Policy requirements are as follows.

The development should target:

- Haringey Local plan - Policy SP4: Working Towards A Low Carbon Haringey
 - A 20% CO₂ reduction from on-site renewable technology sources
- The London Plan Policy SI 2 Minimising greenhouse gas emissions
 - A minimum 35% CO₂ reduction over Part L1 2021 with an aim to achieve zero carbon
 - A 10% CO₂ reduction over Part L1 2021 through energy saving measures

4 Methodology

The Standard Assessment Procedure (SAP) is the UK Government methodology for assessing and calculating the energy performance of dwellings.

The Simplified Building Energy Model (SBEM) is the UK Government methodology for assessing and calculating the energy performance of non-domestic buildings.

SAP and SBEM calculations take into account a range of factors that contribute to energy efficiency, including:

- Materials used for the construction and the thermal insulation of the building fabric (u-values¹ and thermal mass)
- Air permeability
- Efficiency, fuel source, and control of heating and cooling systems
- Ventilation system energy use and heat recovery
- Lighting energy
- Low carbon and energy saving or generating technologies

Approved Document Part L of current Building Regulations addresses the conservation of fuel and power. Part L is divided into two separate documents:

- Part L1 Newly constructed and extended or renovated existing dwellings
- Part L2 Newly constructed and extended or renovated existing non-domestic buildings

To comply with Part L, the calculations should demonstrate how the building will either meet or achieve a percentage reduction in the Building Emission Rate (BER) under the required Target Emission Rate (TER).

The calculation software has been used to calculate a baseline of energy demand and carbon dioxide emissions as appropriate from which any reductions or contributions have been measured.

¹ U-values (Thermal Transmittance) - the measure of the overall rate of heat transfer by all mechanisms under standard conditions, through a particular section of a construction. Lower u-values mean better thermal insulation

5 Baseline Energy & CO2

Energy modelling software has been used to calculate a baseline for the development. This forms the basis from which compliance with planning policy has been measured.

Table 5.1: Baseline CO2 – SAP 2012

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	11.70	1,840	21,591

The **Total Baseline CO2 Emissions** for the development are shown to be 21,591 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

Before considering low carbon energy generating technology the development has been designed to reduce energy demand through the first step of the energy hierarchy by considering 'fabric first'. A thermally efficient building envelope will follow the design with standards as set out below.

Table 6.0: Building Fabric Standards (including u-values W/m²K)

	Part L 2013 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development (Existing)	Proposed Development (New Build)
Walls	0.30	0.18	0.18	0.17
Ground Floor	0.25	0.13	0.18	0.10
Roof	0.20	0.11	0.15	0.10
Windows	2.00	1.2	1.4	1.0 (g-value 0.40)
Doors	2.00	1.0	1.4	1.0
Air permeability	10.00	5.00	N/A	4.00

- Insulation: The specified building envelope is designed to meet or exceed the notional Part L targets and will help to limit the energy demand of the dwelling for space heating
- Thermal bridging: The design will seek to limit heat loss through thermal bridging and targeting a global 'y-value' of 0.05

Once heat retention has been addressed the next step is to ensure energy consuming building services are efficient.

- Space & Water Heating: Air Source Heat Pump
- Heating Controls: Comprising time & temperature zone control
- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Ventilation: Mechanical ventilation with heat recovery with an 88% efficiency and SFP 1.09
- Triple glazed windows with a u-value 1.0W/m²k, G value 0.40

Table 6.1: Baseline vs Be Lean CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	11.70	1,840	21,591	N/A
Be Lean (with notional PV savings included)	10.54	1,840	19,392	10%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 2,199kg/year.

7 Low Carbon Technology Review & Recommendations

Having set out an energy efficient design, the next step is to incorporate low carbon technology for energy generation. A number of technologies exist and should be specified where they:

- Compliance with planning policy
- Are feasible for the site
- Are cost efficient
- Are appropriate for proposed development form and function
- Protect against fuel poverty
- Promote fuel security
- Reduce reliance on fossil fuels
- Reduce carbon emissions
- Reduce resource depletion
- Reduce pollution

Site location and development form and function will influence the suitability of different technologies through:

- Orientation
- Space (inside and outside of the buildings)
- Surrounding topography, structures, and natural features
- Wind speed
- Overshading
- Geology and ground conditions
- Building form, function, and density

In determining the most feasible renewable technologies for the dwelling, the following have been reviewed:

- Wind turbines
- Ground Source Heat Pumps
- Air Source Heat Pumps
- Biomass
- Combined Heat and Power
- Photovoltaic Panels
- Solar water heating

WIND TURBINES

Wind turbines are used to produce electricity. They can be either pole mounted (in a suitably exposed position) or building mounted; building mounted systems need a sufficient wind speed at the structural height and both a structural survey and planning permission.

- Wind speed can be too low on low rise buildings
- Taller systems need sufficient space
- Wind resources very variable and unpredictable
- May need planning permission

Wind turbines technology is **not recommended** for this development

GROUND SOURCE HEAT PUMP (GSHP)

GSHPs use naturally occurring underground low-level heat in areas with appropriate geological features. Heat is transferred from the ground by either extracting and discharging (re-charging) water from/to the ground directly (open loop) or circulating water through pipes buried within the ground, (closed loop). The water is passed through a heat pump to transfer the heat from this water into a higher temperature water circuit to provide heating. The loop can be fitted horizontally (laid in a shallow trench) or vertically (in a borehole).

- Feasibility analysis is costly
- Suitable ground conditions required
- More capital intensive than air source heat pumps
- Can be more efficient and lower running costs than ASHPs
- Well suited to highly insulated buildings

Ground source heat pump technology is **not recommended** for this development

AIR SOURCE HEAT PUMP (ASHP)

ASHP systems absorb heat from outside air at a low temperature into a fluid which is then passed through an electrically driven compressor where its temperature is increased. There are two main types of ASHP systems: Air to Water systems distribute heat through wet central heating; Air to air produce warm air which is circulated by fans. For an ASHP system to be installed, there needs to be ample outdoor space for the external condensing unit; these units can also be noisy and blow out colder air to the neighbouring environment.

- Requires space for external plant and internal hot water tank for wet systems supplying DHW
- Can generate noise though quieter systems have been developed
- Least efficient when most needed
- Longer life than fossil fuel boilers
- High capital costs vs gas systems but lower than GSHPs
- Well suited to highly insulated buildings

Air source heat pump technology **is recommended** for this development

BIOMASS

Biomass systems burn wood pellets, chips, or logs to provide heat in a single room, or to power central heating and hot water boilers. There needs to be ample space available for both the boiler and the storage of fuel. There will also be regular deliveries of fuel and therefore adequate site access is required.

- Carbon emissions are cyclical unlike fossil fuel
- Requires fuel storage space and bulk delivery
- Carbon 'neutral' fuel in isolation but supply side emissions are still present so not neutral overall
- Harmful particulate emissions impact air quality and health

Biomass technology **is not recommended** for this development

COMBINED HEAT AND POWER (CHP)

CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating engine or turbine, which in turn drives an alternator to generate electrical power. The heat emitted by the engine and exhaust gases is recovered and used to heat the building or to provide hot water.

- Reduces consumption of and reliance on grid electricity
- Works best with high and consistent heat and hot water demand
- Recovers waste energy
- Can export to the grid
- Uses fossil fuel
- Emissions on site rather than upstream
- Efficiency is sensitive to sizing

CHP **is not recommended** for this development

DISTRICT HEATING

District Heating systems provide multiple buildings or dwellings with heat and hot water from a central boiler house, or 'energy centre'. The system can provide heating or cooling which is transferred from the energy centre through a network of highly insulated pipes carrying the heated water to each dwelling.



- Economies of scale
- Frees up space in habitable areas of development
- Variety of systems
- Can make use of waste heat from industry
- Can be fossil fuel based and dependent

With reference to the Local Heat Map it has been determined that there are no existing or proposed heat networks or energy centres within a suitable radius from the development and there are no existing networks local to the site

District heating **is not recommended** for this development

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 0.25Watts to 0.35Watts depending on the manufacture.

- Passive technology, requires no energy input from grid
- Does not require sunny days to generate power
- Capital costs can be high although payback is effective
- Needs sufficient roof space and orientation
- Zero site or upstream emissions
- Can export to the grid

Solar PV technology **is recommended** for this development

SOLAR HOT WATER

Solar hot water systems absorb energy from the sun and transfer this energy using heat exchangers to heat water which can then be stored. Systems should be roof mounted and oriented to face between a south-east and south-west direction.

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO2 reductions than other technologies

Solar hot water technology **is not recommended** for this development

Low Carbon Technology Summary

The low carbon technology review indicates that an ASHP with solar PV would be potentially feasible. The following low carbon technology is recommended:

ASHP (winter efficiency 380% and Summer 176%) with Solar PV 3.2kWp for all the dwellings, totalling 28.8kWp for the total development and 5kw batteries in all plots. Due to the limited flat roof space each dwelling is planned to have 8 solar PV panels. When the Solar PV is being installed feasibility should be gained by a specialist installer.

This technology is deemed optimal for meeting the needs of the development and achieving policy compliance. It has been incorporated into the energy model and the results are presented in the next section.

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The ASHP and solar PV have been incorporated into the calculation and the results are set out below.

Table 8.1: Baseline vs Be Green CO2 – SAP 10

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area a (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	10.90	1,840	20,096	N/A
Lean & Green Design	1.9	1,840	3,463	84%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 16,633 kg/year.

The development shows a 74% saving in CO2 via low carbon and renewable technology.

9 Zero Carbon Standard Summary

As previously detailed, this project falls under the London Plan's 2021 'Zero Carbon Policy' which states that major developments (10 dwellings or more) must achieve a minimum reduction of 35% in CO₂ emissions over Part L1 2021 Building Regulations with the view to achieving 'zero carbon'. The remaining amount of CO₂ is subject to a cash in lieu contribution which acts as the alternative to offsetting the zero carbon emissions.

Haringey Council have stipulated that their price is £95 per tonne of carbon charged over a 30-year period. With the specification, we have used to achieve the average 83% reduction in CO₂ emissions over the baseline, this leaves the following tonnes /year for the development.

Image 9.1 has been taken from the GLA spread sheet shows the total on site CO₂ reduction following the energy hierarchy with the required carbon off set payment.

Image 9.1 Carbon Off set payment

	Regulated residential carbon dioxide savings	
	Tonnes CO ₂ per annum	(%)
Be lean: savings from energy demand reduction	2.2	10%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	15.9	74%
Cumulative on site savings	18.1	84%
Annual savings from off-set payment	3.5	-
(Tonnes CO₂)		
Cumulative savings for off-set payment	104	-
Cash in-lieu contribution (£)	9,868	

However, it must be noted that this figure can change depending on the construction specifications, drawings, heating system type or fuel changes, all of which are decided at the Building Regulations design stage. Where SAP calculations will need to be undertaken after planning approval to determine the exact specification that will be incorporated. Only when this is carried out can a more accurate figure of the remaining tonnage of CO₂ be calculated. An 'As Built' SAP calculation and EPC will then be carried out at the post construction stage which will then state the exact amount of CO₂ emissions for each dwelling, in turn only then can the official cash contribution sum be determined.

This energy statement is to provide the feasibility of how the near zero carbon can be achieved with a minimum 35% reduction in CO₂ emissions, what will actually be used to achieve this figure will be decided by a combination of the SAP assessor and the client at building regulations stage.

10 Conclusion

Proposals are for the development named as Collins Court, Cascade Avenue comprising of nine dwellings, two runs of four new build terraces and one converted tennis pavilion to a detached bungalow falling under the requirements of Haringey Council.

- A minimum 35% CO2 reduction over Part L1 2021 with an aim to achieve zero carbon
- A 10% CO2 reduction over Part L1 2021 through energy saving measures
- A 20% CO2 reduction from on-site renewable technology sources

Energy modelling software has been used to calculate a baseline against which compliance with the above can be measured.

The proposed development will be designed to limit energy demand through the inclusion of a thermally efficient building fabric and energy efficient services.

Low carbon technology will be incorporated and is to comprise an ASHP (winter efficiency 380% and Summer 176%) with Solar PV 3.2kWp for all the dwellings, totalling 28.8kWp for the total development with a 5kW battery in all plots.

This results in an 84% CO2 reduction over Part L1 2021. With a total of 10% CO2 reduction through energy saving measures and 74% for the installation of on-site renewable and low carbon technology.

This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the London plan.

11 Appendix 1 – Baseline/Be Lean SAP Worksheets

Full SAP Calculation Printout



Property Reference	S10559 01 04			Issued on Date	06/03/2024
Assessment Reference	Be Lean Gas	Prop Type Ref			
Property	End Terrace, The Grove, The Chine				
SAP Rating	84 B	DER	11.16	TER	11.31
Environmental	88 B	% DER < TER			1.33
CO ₂ Emissions (t/year)	1.99	DFEE	38.74	TFEE	43.94
Compliance Check	See BREL	% DFEE < TFEE			11.83
% DPER < TPER	-10.01	DPER	65.81	TPER	59.82
Assessor Details	Mr. Peter Kinsella			Assessor ID	L770-0002
Client					

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
Basement floor	41.4500 (1a)	x	2.6500 (2a)	=	109.8425 (1a) - (3a)
Ground floor	60.2700 (1b)	x	3.0000 (2b)	=	180.8100 (1b) - (3b)
First floor	65.5800 (1c)	x	3.0000 (2c)	=	196.7400 (1c) - (3c)
Second floor	44.1500 (1d)	x	2.9500 (2d)	=	130.2425 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	211.4500				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	617.6350 (5)

2. Ventilation rate

											m3 per hour			
Number of open chimneys													0 * 80 =	0.0000 (6a)
Number of open flues													0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire													0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler													0 * 20 =	0.0000 (6d)
Number of flues attached to other heater													0 * 35 =	0.0000 (6e)
Number of blocked chimneys													0 * 20 =	0.0000 (6f)
Number of intermittent extract fans													0 * 10 =	0.0000 (7a)
Number of passive vents													0 * 10 =	0.0000 (7b)
Number of flueless gas fires													0 * 40 =	0.0000 (7c)
													Air changes per hour	
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000 (8)	
Pressure test													Yes	
Pressure Test Method													Blower Door	
Measured/design AP50													4.0000 (17)	
Infiltration rate													0.2000 (18)	
Number of sides sheltered													1 (19)	
Shelter factor													(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor													(21) = (18) x (20) =	0.1850 (21)
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														
	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(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) =													70.4000 (23c)	
Effective ac	0.3839	0.3792	0.3746	0.3515	0.3469	0.3237	0.3237	0.3191	0.3330	0.3469	0.3561	0.3654	(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
Triple glazed windows (Uw = 1.00)			28.4300	0.9615	27.3365		(27)
Front door			2.2000	1.0000	2.2000		(26)
RL20			0.4500	1.3258	0.5966		(27a)
RL21			0.4500	1.3258	0.5966		(27a)
Heat Loss Floor 1			41.4500	0.1000	4.1450		(28)
Heat Loss Floor 2			20.8100	0.1000	2.0810		(28a)
Exposed floor			5.3200	0.1000	0.5320		(28b)
External Wall 1	167.5800	28.7900	138.7900	0.1700	23.5943		(29a)
Basement wall	41.2900		41.2900	0.1700	7.0193		(29a)
Dormer wall	3.0700	1.8400	1.2300	0.1700	0.2091		(29a)
External Roof 1	21.9300		21.9300	0.1000	2.1930		(30)
Pitched roof	62.7700	0.9000	61.8700	0.1000	6.1870		(30)

Full SAP Calculation Printout



Bay window roof	1.2000	1.2000	0.1000	0.1200	(30)
Total net area of external elements Aum(A, m2)		365.4200			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		76.8104	(33)
Party Wall 1		103.9300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)					18.2710 (36)
Point Thermal bridges				(36a) =	0.0000
Total fabric heat loss				(33) + (36) + (36a) =	95.0814 (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	78.2412	77.2986	76.3559	71.6426	70.6999	65.9866	65.9866	65.0439	67.8719	70.6999	72.5852	74.4706	(38)
Average = Sum(39)m / 12 =	173.3227	172.3800	171.4373	166.7240	165.7813	161.0680	161.0680	160.1253	162.9533	165.7813	167.6667	169.5520	(39)
												166.4883	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8197	0.8152	0.8108	0.7885	0.7840	0.7617	0.7617	0.7573	0.7706	0.7840	0.7929	0.8019	(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													3.0168 (42)
Hot water usage for mixer showers													
	102.8526	101.3069	99.0546	94.7451	91.5648	88.0182	86.0023	88.2376	90.6879	94.4959	98.8980	102.4585	(42a)
Hot water usage for baths													
	32.2905	31.8109	31.1356	29.8904	28.9581	27.9242	27.3658	28.0364	28.7665	29.8728	31.1436	32.1813	(42b)
Hot water usage for other uses													
	45.5252	43.8697	42.2143	40.5588	38.9033	37.2479	37.2479	38.9033	40.5588	42.2143	43.8697	45.5252	(42c)
Average daily hot water use (litres/day)													166.1516 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	180.6683	176.9876	172.4044	165.1944	159.4262	153.1903	150.6160	155.1774	160.0133	166.5830	173.9113	180.1650	(44)
Energy conte	286.1344	252.0280	264.9792	226.1428	214.6184	188.3654	182.1570	192.1420	197.3124	226.0515	247.7685	282.0949	(45)
Energy content (annual)													
Distribution loss	(46)m = 0.15 x (45)m												
	42.9202	37.8042	39.7469	33.9214	32.1928	28.2548	27.3235	28.8213	29.5969	33.9077	37.1653	42.3142	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Combi loss	28.5024	25.7415	28.4939	27.5627	28.4738	27.5475	28.4608	28.4648	27.5511	28.4784	27.5713	28.5008	(61)
Total heat required for water heating calculated for each month													
	314.6368	277.7695	293.4732	253.7055	243.0922	215.9129	210.6178	220.6068	224.8635	254.5299	275.3398	310.5957	(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	314.6368	277.7695	293.4732	253.7055	243.0922	215.9129	210.6178	220.6068	224.8635	254.5299	275.3398	310.5957	(64)
12Total per year (kWh/year)													3095.1435 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)
													0.0000 (64a)
Heat gains from water heating, kWh/month	102.2653	90.2347	95.2291	82.0832	78.4791	69.5184	67.6824	71.0034	72.4941	82.2817	89.2759	100.9218	(65)

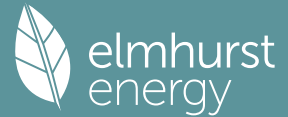
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.6714	235.4577	212.6714	219.7605	212.6714	219.7605	212.6714	212.6714	219.7605	212.6714	219.7605	212.6714	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	381.8014	385.7633	375.7794	354.5249	327.6950	302.4786	285.6325	281.6706	291.6545	312.9089	339.7389	364.9553	(68)
Pumps, fans	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	(69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Water heating gains (Table 5)	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	(71)
Total internal gains	137.4533	134.2778	127.9961	114.0044	105.4826	96.5533	90.9710	95.4347	100.6863	110.5937	123.9942	135.6475	(72)
	803.1783	826.7509	787.6991	759.5420	717.1012	687.0446	657.5271	658.0289	680.3535	707.4263	754.7458	784.5264	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North						3.4600	10.6334	0.4000	0.0000	0.7700	11.3318 (74)	
East						15.3000	19.6403	0.4000	0.0000	0.7700	92.5528 (76)	
Southwest						1.7500	36.7938	0.4000	0.0000	0.7700	19.8319 (79)	
West						6.1700	19.6403	0.4000	0.0000	0.7700	37.3236 (80)	
Northwest						1.7500	11.2829	0.4000	0.0000	0.7700	6.0815 (81)	
West						0.9000	25.5349	0.6300	0.7000	1.0000	9.1213 (82)	
Solar gains	176.2428	340.0745	554.5894	809.6819	999.0997	1027.1806	976.0056	832.7630	644.4510	401.5328	218.7613	145.6507 (83)
Total gains	979.4212	1166.8254	1342.2885	1569.2239	1716.2009	1714.2252	1633.5327	1490.7920	1324.8044	1108.9591	973.5071	930.1772 (84)

Full SAP Calculation Printout



7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.7208	85.1841	85.6525	88.0739	88.5747	91.1666	91.1666	91.7033	90.1119	88.5747	87.5787	86.6049	21.0000 (85)
alpha	6.6481	6.6789	6.7102	6.8716	6.9050	7.0778	7.0778	7.1136	7.0075	6.9050	6.8386	6.7737	
util living area	0.9995	0.9982	0.9926	0.9541	0.8221	0.5947	0.4332	0.4924	0.7931	0.9825	0.9985	0.9997	(86)
MIT	20.1783	20.3013	20.4862	20.7431	20.9017	20.9514	20.9556	20.9553	20.9255	20.6965	20.4021	20.1752	(87)
Th 2	20.2363	20.2402	20.2440	20.2633	20.2672	20.2866	20.2866	20.2905	20.2788	20.2672	20.2595	20.2517	(88)
util rest of house	0.9993	0.9976	0.9900	0.9391	0.7778	0.5313	0.3633	0.4174	0.7300	0.9744	0.9979	0.9995	(89)
MIT 2	19.2505	19.4113	19.6503	19.9855	20.1648	20.2276	20.2301	20.2340	20.2011	19.9365	19.5567	19.2594	(90)
Living area fraction										fLA = Living area / (4) =		0.1145	(91)
MIT	19.3568	19.5132	19.7460	20.0722	20.2491	20.3105	20.3132	20.3166	20.2840	20.0235	19.6535	19.3643	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3568	19.5132	19.7460	20.0722	20.2491	20.3105	20.3132	20.3166	20.2840	20.0235	19.6535	19.3643	(93)

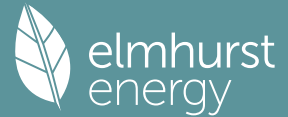
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9968	0.9878	0.9345	0.7766	0.5335	0.3659	0.4202	0.7305	0.9708	0.9972	0.9993	(94)
Useful gains	978.5147	1163.1466	1325.8885	1466.4499	1332.8318	914.5374	597.7622	626.3805	967.7802	1076.6161	970.8175	929.5708	(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	2609.6779	2519.0283	2270.8630	1862.6775	1417.2889	919.7708	598.0714	627.1491	1007.7080	1562.2435	2104.8033	2571.1330	(97)
Space heating kWh	1213.5854	911.1526	703.0610	285.2838	62.8361	0.0000	0.0000	0.0000	0.0000	361.3068	816.4697	1221.3223	(98a)
Space heating requirement - total per year (kWh/year)												5575.0177	
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	1213.5854	911.1526	703.0610	285.2838	62.8361	0.0000	0.0000	0.0000	0.0000	361.3068	816.4697	1221.3223	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5575.0177	
Space heating per m2										(98c) / (4) =		26.3657	(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 %)													83.7000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	1213.5854	911.1526	703.0610	285.2838	62.8361	0.0000	0.0000	0.0000	0.0000	361.3068	816.4697	1221.3223	(98)
Space heating efficiency (main heating system 1)	83.7000	83.7000	83.7000	83.7000	83.7000	0.0000	0.0000	0.0000	0.0000	83.7000	83.7000	83.7000	(210)
Space heating fuel (main heating system)	1449.9228	1088.5933	839.9773	340.8409	75.0730	0.0000	0.0000	0.0000	0.0000	431.6688	975.4716	1459.1664	(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	314.6368	277.7695	293.4732	253.7055	243.0922	215.9129	210.6178	220.6068	224.8635	254.5299	275.3398	310.5957	(64)
Efficiency of water heater (217)m	88.4713	88.4405	88.3732	88.1788	87.8237	87.6000	87.6000	87.6000	87.6000	88.2420	88.4200	88.4747	(216)
Fuel for water heating, kWh/month	355.6372	314.0749	332.0839	287.7171	276.7956	246.4759	240.4313	251.8342	256.6935	288.4452	311.3999	351.0558	(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	94.5002	85.3550	94.5002	91.4518	94.5002	91.4518	94.5002	94.5002	91.4518	94.5002	91.4518	94.5002	(231)
Lighting	59.4449	47.6889	42.9386	31.4587	24.2996	19.8530	22.1669	28.8134	37.4257	49.1045	55.4635	61.0971	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235a)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235c)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235c)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)													
(234b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)													
(235b)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)													
(235d)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(235d)
Annual totals kWh/year													
Space heating fuel - main system 1												6660.7141	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												87.6000	
Water heating fuel used												3512.6445	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3625)													
mechanical ventilation fans (SFP = 1.3625)												1026.6638	(230a)
central heating pump												41.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												1112.6638	(231)
Electricity for lighting (calculated in Appendix L)												479.7548	(232)

Full SAP Calculation Printout



Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	0.0000 (233)
Wind generation	0.0000 (234)
Hydro-electric generation (Appendix N)	0.0000 (235a)
Electricity generated - Micro CHP (Appendix N)	0.0000 (235)
Appendix Q - special features	
Energy saved or generated	-0.0000 (236)
Energy used	0.0000 (237)
Total delivered energy for all uses	11765.7771 (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	6660.7141	0.2100	1398.7500 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	3512.6445	0.2100	737.6553 (264)
Space and water heating			2136.4053 (265)
Pumps, fans and electric keep-hot	1112.6638	0.1387	154.3402 (267)
Energy for lighting	479.7548	0.1443	69.2434 (268)
Total CO2, kg/year			2359.9889 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			11.1600 (273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6660.7141	1.1300	7526.6070 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3512.6445	1.1300	3969.2883 (278)
Space and water heating			11495.8952 (279)
Pumps, fans and electric keep-hot	1112.6638	1.5128	1683.2378 (281)
Energy for lighting	479.7548	1.5338	735.8639 (282)
Total Primary energy kWh/year			13914.9969 (286)
Dwelling Primary energy Rate (DPER)			65.8100 (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)
Basement floor	41.4500 (1a)	x 2.6500 (2a)	= 109.8425 (1a) - (3a)
Ground floor	60.2700 (1b)	x 3.0000 (2b)	= 180.8100 (1b) - (3b)
First floor	65.5800 (1c)	x 3.0000 (2c)	= 196.7400 (1c) - (3c)
Second floor	44.1500 (1d)	x 2.9500 (2d)	= 130.2425 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	211.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 617.6350 (5)

2. Ventilation rate

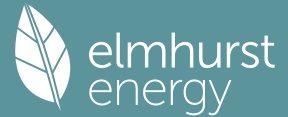
	m3 per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number 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) = 0.0648 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3148 (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) = 0.2912 (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	0.3712	0.3639	0.3567	0.3203	0.3130	0.2766	0.2766	0.2693	0.2912	0.3130	0.3276	0.3421 (22b)
Effective ac	0.5689	0.5662	0.5636	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5536	0.5585 (25)

3. Heat losses and heat loss parameter

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

Full SAP Calculation Printout



	m2	m2	m2	W/m2K	W/K	kJ/m2K	kJ/K	
TER Opaque door			2.2000	1.0000	2.2000			(26)
TER Opening Type (Uw = 1.20)			28.4300	1.1450	32.5534			(27)
RL20			0.4500	1.4151	0.6368			(27a)
RL21			0.4500	1.4151	0.6368			(27a)
Heat Loss Floor 1			41.4500	0.1300	5.3885			(28)
Heat Loss Floor 2			20.8100	0.1300	2.7053			(28a)
Exposed floor			5.3200	0.1300	0.6916			(28b)
External Wall 1	167.5800	28.7900	138.7900	0.1800	24.9822			(29a)
Basement wall	41.2900		41.2900	0.1800	7.4322			(29a)
Dormer wall	3.0700	1.8400	1.2300	0.1800	0.2214			(29a)
External Roof 1	21.9300		21.9300	0.1100	2.4123			(30)
Pithced roof	62.7700	0.9000	61.8700	0.1100	6.8057			(30)
Bay window roof	1.2000		1.2000	0.1100	0.1320			(30)
Total net area of external elements Aum(A, m2)			365.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.7982			(33)
Party Wall 1			103.9300	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)

List of Thermal Bridges	Length	Psi-value	Total	
K1 Element	20.1400	0.0500	1.0070	
E2 Other lintels (including other steel lintels)	19.1400	0.0500	0.9570	
E3 Sill	63.1400	0.0500	3.1570	
E4 Jamb	16.6100	0.1600	2.6576	
E5 Ground floor (normal)	8.3000	0.3200	2.6560	
E20 Exposed floor (normal)	8.3000	0.3200	2.6560	
E21 Exposed floor (inverted)	15.5800	0.0700	1.0906	
E22 Basement floor	43.3000	0.0000	0.0000	
E6 Intermediate floor within a dwelling	24.7000	0.0400	0.9880	
E11 Eaves (insulation at rafter level)	4.8800	0.0800	0.3904	
E13 Gable (insulation at rafter level)	23.4900	0.0800	1.8792	
E14 Flat roof	33.3500	0.0900	3.0015	
E16 Corner (normal)	18.0000	-0.0900	-1.6200	
E17 Corner (inverted - internal area greater than external area)	18.0000	0.0600	1.0800	
E18 Party wall between dwellings	10.2200	0.0800	0.8176	
P1 Party wall - Ground floor	26.2500	0.0000	0.0000	
P2 Party wall - Intermediate floor within a dwelling	4.5700	0.1200	0.5484	
P4 Party wall - Roof (insulation at ceiling level)	8.1400	0.0800	0.6512	
P5 Party wall - Roof (insulation at rafter level)	1.1000	0.0800	0.0880	
R1 Head of roof window	1.1000	0.0600	0.0660	
R2 Sill of roof window	3.2800	0.0800	0.2624	
R3 Jamb of roof window	9.6700	0.0800	0.7736	
R4 Ridge (vaulted ceiling)	12.9700	0.0400	0.5188	
R5 Ridge (inverted)				

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 23.6263 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 110.4245 (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	115.9537	115.4083	114.8738	112.3631	111.8933	109.7065	109.7065	109.3016	110.5488	111.8933	112.8436	113.8371	(38)
Average = Sum(39)m / 12 =	226.3782	225.8328	225.2983	222.7876	222.3178	220.1311	220.1311	219.7261	220.9734	222.3178	223.2681	224.2616	(39)
												222.7853	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.0706	1.0680	1.0655	1.0536	1.0514	1.0411	1.0411	1.0391	1.0450	1.0514	1.0559	1.0606	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

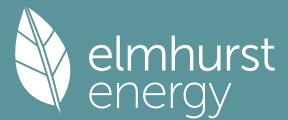
4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0168	(42)
Hot water usage for mixer showers														
74.8019	73.6778	72.0397	68.9055	66.5926	64.0133	62.5471	64.1728	65.9549	68.7243	71.9258	74.5153	74.5153	(42a)	
Hot water usage for baths														
32.2905	31.8109	31.1356	29.8904	28.9581	27.9242	27.3658	28.0364	28.7665	29.8728	31.1436	32.1813	32.1813	(42b)	
Hot water usage for other uses														
45.5252	43.8697	42.2143	40.5588	38.9033	37.2479	37.2479	38.9033	40.5588	42.2143	43.8697	45.5252	45.5252	(42c)	
Average daily hot water use (litres/day)													140.2897	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	152.6176	149.3584	145.3896	139.3548	134.4540	129.1854	127.1608	131.1125	135.2802	140.8114	146.9391	152.2218	(44)	
Energy content (annual)	241.7089	212.6844	223.4583	190.7697	181.0010	158.8485	153.7900	162.3447	166.8140	191.0797	209.3417	238.3426	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		2330.1835		
36.2563	31.9027	33.5188	28.6155	27.1501	23.8273	23.0685	24.3517	25.0221	28.6620	31.4013	35.7514	(46)		
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)	
Combi loss	50.9589	46.0274	50.9589	49.3151	50.9589	49.3151	50.9589	50.9589	49.3151	50.9589	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month														
292.6678	258.7118	274.4172	240.0848	231.9599	208.1635	204.7489	213.3036	216.1291	242.0386	258.6568	289.3015	(62)		
WWHRS	-34.1963	-30.2435	-31.6692	-26.2234	-24.4393	-20.9128	-19.6025	-20.8452	-21.6372	-25.5079	-28.8974	-33.5630	(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	258.4715	228.4683	242.7480	213.8614	207.5206	187.2507	185.1464	192.4584	194.4919	216.5307	229.7594	255.7384	(64)	
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		2612.4457	(64)	
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
													0.0000	(64a)
Heat gains from water heating, kWh/month														
93.1079	82.2244	87.0396	75.7597	72.9225	65.1459	63.8749	66.7193	67.7944	76.2737	81.9349	91.9886	(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
----------------------------------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Full SAP Calculation Printout



(66)m	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.7324	228.8823	206.7324	213.6235	206.7324	213.6235	206.7324	206.7324	213.6235	206.7324	213.6235	206.7324	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.8014	385.7633	375.7794	354.5249	327.6950	302.4786	285.6325	281.6706	291.6545	312.9089	339.7389	364.9553	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	(71)
Water heating gains (Table 5)	125.1451	122.3578	116.9887	105.2218	98.0142	90.4804	85.8534	89.6765	94.1589	102.5184	113.7985	123.6406	(72)
Total internal gains	784.9311	808.2555	770.7527	744.6224	703.6937	674.8347	646.4705	646.3317	667.6891	693.4120	738.4130	766.5805	(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				

North					3.4600	10.6334		0.6300	0.7000	0.7700		11.2440 (74)				
East					15.3000	19.6403		0.6300	0.7000	0.7700		91.8355 (76)				
Southwest					1.7500	36.7938		0.6300	0.7000	0.7700		19.6782 (79)				
West					6.1700	19.6403		0.6300	0.7000	0.7700		37.0343 (80)				
Northwest					1.7500	11.2829		0.6300	0.7000	0.7700		6.0344 (81)				
West					0.9000	25.5349		0.6300	0.7000	1.0000		9.1213 (82)				

Solar gains					174.9477	337.5799	550.5304	803.7668	991.8080	1019.6866	968.8839	826.6822	639.7382	398.5900	217.1545	144.5797 (83)
Total gains					959.8787	1145.8354	1321.2832	1548.3892	1695.5018	1694.5213	1615.3543	1473.0140	1307.4273	1092.0020	955.5675	911.1603 (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	64.8650	65.0217	65.1759	65.9104	66.0497	66.7058	66.7058	66.8288	66.4516	66.0497	65.7686	65.4772	
alpha	5.3243	5.3348	5.3451	5.3940	5.4033	5.4471	5.4471	5.4553	5.4301	5.4033	5.3846	5.3651	
util living area	0.9995	0.9986	0.9953	0.9780	0.9144	0.7577	0.5842	0.6559	0.9015	0.9908	0.9988	0.9996	(86)
MIT	19.5488	19.7176	19.9950	20.3904	20.7330	20.9354	20.9872	20.9769	20.8211	20.3649	19.8915	19.5277	(87)
Th 2	20.0249	20.0270	20.0291	20.0389	20.0407	20.0493	20.0493	20.0508	20.0460	20.0407	20.0370	20.0331	(88)
util rest of house	0.9993	0.9980	0.9935	0.9689	0.8790	0.6726	0.4659	0.5354	0.8466	0.9857	0.9983	0.9995	(89)
MIT 2	18.3084	18.5262	18.8825	19.3891	19.7996	20.0096	20.0449	20.0419	19.9086	19.3634	18.7566	18.2873	(90)
Living area fraction	fLA = Living area / (4) =												0.1145 (91)
MIT	18.4504	18.6627	19.0099	19.5038	19.9065	20.1156	20.1527	20.1489	20.0131	19.4781	18.8866	18.4293	(92)
Temperature adjustment													0.0000
adjusted MIT	18.4504	18.6627	19.0099	19.5038	19.9065	20.1156	20.1527	20.1489	20.0131	19.4781	18.8866	18.4293	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9989	0.9969	0.9907	0.9622	0.8730	0.6791	0.4793	0.5486	0.8442	0.9813	0.9973	0.9991	(94)
Ext temp.	958.7796	1142.3016	1308.9461	1489.8183	1480.2205	1150.7546	774.2370	808.1285	1103.7653	1071.6239	952.9611	910.3782	(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	3203.3394	3108.0595	2818.4593	2362.3861	1824.4519	1214.1466	782.0693	823.7354	1306.6395	1973.7626	2631.5632	3191.0884	(97)
Space heating requirement - total per year (kWh/year)	1669.9525	1320.9893	1123.0778	628.2488	256.1082	0.0000	0.0000	0.0000	0.0000	671.1912	1208.5935	1696.8484	(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)	1669.9525	1320.9893	1123.0778	628.2488	256.1082	0.0000	0.0000	0.0000	0.0000	671.1912	1208.5935	1696.8484	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)													8575.0097
Space heating per m2	(98c) / (4) =												40.5534 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.4000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating efficiency (main heating system 1)	1669.9525	1320.9893	1123.0778	628.2488	256.1082	0.0000	0.0000	0.0000	0.0000	671.1912	1208.5935	1696.8484	(98)
Space heating fuel (main heating system)	92.4000	92.4000	92.4000	92.4000	92.4000	0.0000	0.0000	0.0000	0.0000	92.4000	92.4000	92.4000	(210)
Space heating efficiency (main heating system 2)	1807.3079	1429.6421	1215.4521	679.9229	277.1734	0.0000	0.0000	0.0000	0.0000	726.3974	1308.0016	1836.4160	(211)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Space heating fuel (secondary)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	258.4715	228.4683	242.7480	213.8614	207.5206	187.2507	185.1464	192.4584	194.4919	216.5307	229.7594	255.7384	(64)
Efficiency of water heater	87.6419	87.5179	87.2394	86.5461	84.8333	80.3000	80.3000	80.3000	80.3000	86.6368	87.4047	87.6702	(216)
(217)m													(217)

Full SAP Calculation Printout



Fuel for water heating, kWh/month	294.9176	261.0531	278.2549	247.1070	244.6216	233.1889	230.5684	239.6742	242.2065	249.9293	262.8685	291.7049	(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	42.9549	34.4600	31.0274	22.7320	17.5589	14.3457	16.0178	20.8205	27.0438	35.4829	40.0779	44.1488	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-42.6765	-62.2996	-92.6407	-107.7971	-119.2755	-112.3072	-110.8256	-103.0889	-90.0197	-72.7650	-47.6350	-36.6437	(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	-18.0145	-38.4672	-77.5692	-118.1896	-157.9978	-159.4943	-157.7243	-132.8354	-96.3637	-55.6751	-24.2541	-14.2105	(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												9280.3135	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												80.3000	
Water heating fuel used												3076.0950	(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)												346.6707	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-2048.7701	(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												10740.3092	(238)

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

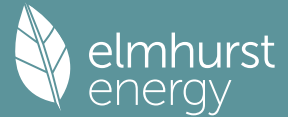
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	9280.3135	0.2100	1948.8658	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3076.0950	0.2100	645.9800	(264)
Space and water heating			2594.8458	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	346.6707	0.1443	50.0353	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-997.9745	0.1339	-133.6263	
PV Unit electricity exported	-1050.7956	0.1255	-131.8312	
Total			-265.4575	(269)
Total CO2, kg/year			2391.3528	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.3100	(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	9280.3135	1.1300	10486.7543	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3076.0950	1.1300	3475.9874	(278)
Space and water heating			13962.7416	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	346.6707	1.5338	531.7352	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-997.9745	1.4948	-1491.7961	
PV Unit electricity exported	-1050.7956	0.4605	-483.8876	
Total			-1975.6837	(283)
Total Primary energy kWh/year			12648.8938	(286)
Target Primary Energy Rate (TPER)			59.8200	(287)

12 Appendix 2 - Be Green SAP Worksheets

Full SAP Calculation Printout



Property Reference	S10559 01 04				Issued on Date	06/03/2024	
Assessment Reference	Be green			Prop Type Ref			
Property	End Terrace, The Grove, The Chine						
SAP Rating	90 B		DER	1.81		TER	11.15
Environmental	98 A		% DER < TER				83.77
CO ₂ Emissions (t/year)	0.3		DFEE	38.74		TFEE	43.94
Compliance Check	See BREL		% DFEE < TFEE				11.83
% DPER < TPER	66.32		DPER	19.86		TPER	58.97
Assessor Details	Mr. Peter Kinsella					Assessor ID	L770-0002
Client							

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

1. Overall dwelling characteristics

	Area (m ²)		Storey height (m)		Volume (m ³)
Basement floor	41.4500 (1a)	x	2.6500 (2a)	=	109.8425 (1a) - (3a)
Ground floor	60.2700 (1b)	x	3.0000 (2b)	=	180.8100 (1b) - (3b)
First floor	65.5800 (1c)	x	3.0000 (2c)	=	196.7400 (1c) - (3c)
Second floor	44.1500 (1d)	x	2.9500 (2d)	=	130.2425 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	211.4500				(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	617.6350 (5)

2. Ventilation rate

											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached to other heater											0 * 35 =	0.0000 (6e)	
Number of blocked chimneys											0 * 20 =	0.0000 (6f)	
Number of intermittent extract fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
											Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Pressure Test Method											Blower Door		
Measured/design AP50											4.0000 (17)		
Infiltration rate											0.2000 (18)		
Number of sides sheltered											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1850 (21)	
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													
	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174 (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) =													70.4000 (23c)
Effective ac	0.3839	0.3792	0.3746	0.3515	0.3469	0.3237	0.3237	0.3191	0.3330	0.3469	0.3561	0.3654 (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
Triple glazed windows (Uw = 1.00)			28.4300	0.9615	27.3365		(27)
Front door			2.2000	1.0000	2.2000		(26)
RL20			0.4500	1.3258	0.5966		(27a)
RL21			0.4500	1.3258	0.5966		(27a)
Heat Loss Floor 1			41.4500	0.1000	4.1450		(28)
Heat Loss Floor 2			20.8100	0.1000	2.0810		(28a)
Exposed floor			5.3200	0.1000	0.5320		(28b)
External Wall 1	167.5800	28.7900	138.7900	0.1700	23.5943		(29a)
Basement wall	41.2900		41.2900	0.1700	7.0193		(29a)
Dormer wall	3.0700	1.8400	1.2300	0.1700	0.2091		(29a)
External Roof 1	21.9300		21.9300	0.1000	2.1930		(30)
Pitched roof	62.7700	0.9000	61.8700	0.1000	6.1870		(30)

Full SAP Calculation Printout



Bay window roof	1.2000	1.2000	0.1000	0.1200	(30)
Total net area of external elements Aum(A, m2)		365.4200			(31)
Fabric heat loss, W/K = Sum (A x U)		(26)...(30) + (32) =		76.8104	(33)
Party Wall 1		103.9300	0.0000	0.0000	(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)					18.2710 (36)
Point Thermal bridges					0.0000
Total fabric heat loss				(33) + (36) + (36a) =	95.0814 (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	78.2412	77.2986	76.3559	71.6426	70.6999	65.9866	65.9866	65.0439	67.8719	70.6999	72.5852	74.4706	(38)
Average = Sum(39)m / 12 =	173.3227	172.3800	171.4373	166.7240	165.7813	161.0680	161.0680	160.1253	162.9533	165.7813	167.6667	169.5520	(39)
												166.4883	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	0.8197	0.8152	0.8108	0.7885	0.7840	0.7617	0.7617	0.7573	0.7706	0.7840	0.7929	0.8019	(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													3.0168 (42)
Hot water usage for mixer showers													
	102.8526	101.3069	99.0546	94.7451	91.5648	88.0182	86.0023	88.2376	90.6879	94.4959	98.8980	102.4585	(42a)
Hot water usage for baths													
	32.2905	31.8109	31.1356	29.8904	28.9581	27.9242	27.3658	28.0364	28.7665	29.8728	31.1436	32.1813	(42b)
Hot water usage for other uses													
	45.5252	43.8697	42.2143	40.5588	38.9033	37.2479	37.2479	38.9033	40.5588	42.2143	43.8697	45.5252	(42c)
Average daily hot water use (litres/day)												166.1516	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	180.6683	176.9876	172.4044	165.1944	159.4262	153.1903	150.6160	155.1774	160.0133	166.5830	173.9113	180.1650	(44)
Energy conte	286.1344	252.0280	264.9792	226.1428	214.6184	188.3654	182.1570	192.1420	197.3124	226.0515	247.7685	282.0949	(45)
Energy content (annual)										Total = Sum(45)m =		2759.7944	
Distribution loss (46)m = 0.15 x (45)m													
	42.9202	37.8042	39.7469	33.9214	32.1928	28.2548	27.3235	28.8213	29.5969	33.9077	37.1653	42.3142	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0206	(55)
Total storage loss													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)
If cylinder contains dedicated solar storage													
	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(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													
	341.0354	301.6160	319.8802	279.2728	269.5194	241.4954	237.0580	247.0430	250.4424	280.9525	300.8985	336.9959	(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	341.0354	301.6160	319.8802	279.2728	269.5194	241.4954	237.0580	247.0430	250.4424	280.9525	300.8985	336.9959	(64)
12Total per year (kWh/year)												3406.2094	(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													
	139.0605	123.4697	132.0264	117.6965	115.2814	105.1355	104.4880	107.8080	108.1104	119.0829	124.8870	137.7174	(65)

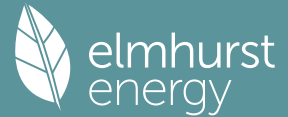
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	212.6714	235.4577	212.6714	219.7605	212.6714	219.7605	212.6714	212.6714	219.7605	212.6714	219.7605	212.6714	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	381.8014	385.7633	375.7794	354.5249	327.6950	302.4786	285.6325	281.6706	291.6545	312.9089	339.7389	364.9553	(68)
Pumps, fans	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	(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	0.0000	(70)
Water heating gains (Table 5)	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	(71)
Total internal gains	186.9093	183.7347	177.4548	163.4673	154.9481	146.0215	140.4409	144.9032	150.1533	160.0577	173.4542	185.1040	(72)
	849.6343	873.2078	834.1579	806.0050	763.5667	736.5128	706.9970	707.4975	729.8204	753.8903	801.2058	830.9829	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF factor Table 6d				Gains W
North					3.4600	10.6334	0.4000	0.0000		0.7700			11.3318 (74)
East					15.3000	19.6403	0.4000	0.0000		0.7700			92.5528 (76)
Southwest					1.7500	36.7938	0.4000	0.0000		0.7700			19.8319 (79)
West					6.1700	19.6403	0.4000	0.0000		0.7700			37.3236 (80)
Northwest					1.7500	11.2829	0.4000	0.0000		0.7700			6.0815 (81)
West					0.9000	25.5349	0.6300	0.7000		1.0000			9.1213 (82)
Solar gains	176.2428	340.0745	554.5894	809.6819	999.0997	1027.1806	976.0056	832.7630	644.4510	401.5328	218.7613	145.6507	(83)

Full SAP Calculation Printout



Total gains 1025.8771 1213.2823 1388.7472 1615.6868 1762.6665 1763.6934 1683.0026 1540.2605 1374.2714 1155.4231 1019.9671 976.6336 (84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	84.7208	85.1841	85.6525	88.0739	88.5747	91.1666	91.1666	91.7033	90.1119	88.5747	87.5787	86.6049	21.0000 (85)
alpha	6.6481	6.6789	6.7102	6.8716	6.9050	7.0778	7.0778	7.1136	7.0075	6.9050	6.8386	6.7737	
util living area	0.9993	0.9978	0.9910	0.9476	0.8081	0.5790	0.4206	0.4769	0.7726	0.9783	0.9980	0.9995	(86)
Living	20.1970	20.3199	20.5040	20.7568	20.9072	20.9521	20.9557	20.9555	20.9300	20.7131	20.4207	20.1940	
Non living	19.2745	19.4350	19.6728	20.0014	20.1698	20.2280	20.2301	20.2341	20.2045	19.9566	19.5805	19.2835	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	3	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	28	0	0	0	0	0	0	0	0	0	0	10	
MIT	20.5892	20.3199	20.5040	20.7568	20.9072	20.9521	20.9557	20.9555	20.9300	20.7131	20.4207	20.3068	(87)
Th 2	20.2363	20.2402	20.2440	20.2633	20.2672	20.2866	20.2866	20.2905	20.2788	20.2672	20.2595	20.2517	(88)
util rest of house	0.9991	0.9970	0.9880	0.9310	0.7627	0.5169	0.3527	0.4041	0.7085	0.9685	0.9972	0.9994	(89)
MIT 2	19.8529	19.4350	19.6728	20.0014	20.1698	20.2280	20.2301	20.2341	20.2045	19.9566	19.5805	19.4580	(90)
Living area fraction									fLA = Living area / (4) =			0.1145	(91)
MIT	19.9372	19.5363	19.7679	20.0879	20.2542	20.3109	20.3132	20.3167	20.2876	20.0432	19.6767	19.5552	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.9372	19.5363	19.7679	20.0879	20.2542	20.3109	20.3132	20.3167	20.2876	20.0432	19.6767	19.5552	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9961	0.9855	0.9264	0.7619	0.5190	0.3552	0.4068	0.7093	0.9646	0.9964	0.9992	(94)
Useful gains	1024.8775	1208.5270	1368.5646	1496.7240	1342.9068	915.4292	597.8221	626.5393	974.8259	1114.5587	1016.2868	975.8368	(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	2710.2783	2523.0114	2274.6205	1865.2927	1418.1273	919.8436	598.0767	627.1628	1008.2877	1565.5107	2108.7002	2603.5008	(97)
Space heating kWh	1253.9382	883.3335	674.1056	265.3695	55.9641	0.0000	0.0000	0.0000	0.0000	335.5083	786.5377	1210.9820	(98a)
Space heating requirement - total per year (kWh/year)												5465.7388	
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	1253.9382	883.3335	674.1056	265.3695	55.9641	0.0000	0.0000	0.0000	0.0000	335.5083	786.5377	1210.9820	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												5465.7388	
Space heating per m2										(98c) / (4) =		25.8488	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)

Fraction of space heat from main system(s)	0.0000 (201)
Efficiency of main space heating system 1 (in %)	1.0000 (202)
Efficiency of main space heating system 2 (in %)	378.6731 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (207)
	0.0000 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1253.9382	883.3335	674.1056	265.3695	55.9641	0.0000	0.0000	0.0000	0.0000	335.5083	786.5377	1210.9820	(98)
Space heating efficiency (main heating system 1)	378.6731	378.6731	378.6731	378.6731	378.6731	0.0000	0.0000	0.0000	0.0000	378.6731	378.6731	378.6731	(210)
Space heating fuel (main heating system)	331.1400	233.2707	178.0178	70.0788	14.7790	0.0000	0.0000	0.0000	0.0000	88.6010	207.7089	319.7962	(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	341.0354	301.6160	319.8802	279.2728	269.5194	241.4954	237.0580	247.0430	250.4424	280.9525	300.8985	336.9959	(64)
Efficiency of water heater (217)m	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	175.4415	(216)
Fuel for water heating, kWh/month	194.3870	171.9183	182.3287	159.1829	153.6235	137.6501	135.1208	140.8122	142.7498	160.1403	171.5093	192.0845	(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	76.7326	69.3068	76.7326	74.2573	76.7326	74.2573	76.7326	76.7326	74.2573	76.7326	74.2573	76.7326	(231)
Lighting	59.4449	47.6889	42.9386	31.4587	24.2996	19.8530	22.1669	28.8134	37.4257	49.1045	55.4635	61.0971	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-48.3552	-88.2841	-165.8575	-231.4997	-282.3728	-274.9064	-269.5590	-235.3091	-178.6667	-115.6183	-58.7117	-39.2057	(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	-1.1655	-4.6132	-16.9879	-44.9803	-83.3181	-93.7336	-90.4180	-63.7194	-33.3013	-10.0880	-2.1139	-0.7917	(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												1443.3925	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												175.4415	
Water heating fuel used												1941.5074	(219)
Space cooling fuel												0.0000	(221)

Full SAP Calculation Printout



Electricity for pumps and fans:	
(BalancedWithHeatRecovery, Database: in-use factor = 1.1000, SFP = 1.1990)	
mechanical ventilation fans (SFP = 1.1990)	903.4641 (230a)
Total electricity for the above, kWh/year	903.4641 (231)
Electricity for lighting (calculated in Appendix L)	479.7548 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-2433.5770 (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	2334.5418 (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	1443.3925	0.1566	226.0485 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	1941.5074	0.1410	273.8194 (264)
Space and water heating			499.8679 (265)
Pumps, fans and electric keep-hot	903.4641	0.1387	125.3216 (267)
Energy for lighting	479.7548	0.1443	69.2434 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.3461	0.1307	-259.8031
PV Unit electricity exported	-445.2308	0.1156	-51.4565
Total			-311.2595 (269)
Total CO2, kg/year			383.1734 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.8100 (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	1443.3925	1.5798	2280.2350 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	1941.5074	1.5215	2954.0055 (278)
Space and water heating			5234.2404 (279)
Pumps, fans and electric keep-hot	903.4641	1.5128	1366.7605 (281)
Energy for lighting	479.7548	1.5338	735.8639 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-1988.3461	1.4827	-2948.0958
PV Unit electricity exported	-445.2308	0.4236	-188.5934
Total			-3136.6891 (283)
Total Primary energy kWh/year			4200.1757 (286)
Dwelling Primary energy Rate (DPER)			19.8600 (287)

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

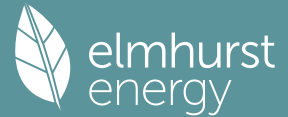
1. Overall dwelling characteristics

	Area (m2)	Storey height (m)	Volume (m3)
Basement floor	41.4500 (1a)	x 2.6500 (2a)	= 109.8425 (1a) - (3a)
Ground floor	60.2700 (1b)	x 3.0000 (2b)	= 180.8100 (1b) - (3b)
First floor	65.5800 (1c)	x 3.0000 (2c)	= 196.7400 (1c) - (3c)
Second floor	44.1500 (1d)	x 2.9500 (2d)	= 130.2425 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	211.4500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	617.6350 (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) = 0.0648 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.3148 (18)
Number of sides sheltered	1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 0.9250 (20)

Full SAP Calculation Printout



Infiltration rate adjusted to include shelter factor

(21) = (18) x (20) = 0.2912 (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	0.3712	0.3639	0.3567	0.3203	0.3130	0.2766	0.2766	0.2693	0.2912	0.3130	0.3276	0.3421 (22b)
Effective ac	0.5689	0.5662	0.5636	0.5513	0.5490	0.5383	0.5383	0.5363	0.5424	0.5490	0.5536	0.5585 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.2000	1.0000	2.2000		(26)
TER Opening Type (Uw = 1.20)			28.4300	1.1450	32.5534		(27)
RL20			0.4500	1.4151	0.6368		(27a)
RL21			0.4500	1.4151	0.6368		(27a)
Heat Loss Floor 1			41.4500	0.1300	5.3885		(28)
Heat Loss Floor 2			20.8100	0.1300	2.7053		(28a)
Exposed floor			5.3200	0.1300	0.6916		(28b)
External Wall 1	167.5800	28.7900	138.7900	0.1800	24.9822		(29a)
Basement wall	41.2900		41.2900	0.1800	7.4322		(29a)
Dormer wall	3.0700	1.8400	1.2300	0.1800	0.2214		(29a)
External Roof 1	21.9300		21.9300	0.1100	2.4123		(30)
Pithced roof	62.7700	0.9000	61.8700	0.1100	6.8057		(30)
Bay window roof	1.2000		1.2000	0.1100	0.1320		(30)
Total net area of external elements Aum(A, m2)			365.4200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	86.7982		(33)
Party Wall 1			103.9300	0.0000	0.0000		(32)

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

250.0000 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	20.1400	0.0500	1.0070
E3 Sill	19.1400	0.0500	0.9570
E4 Jamb	63.1400	0.0500	3.1570
E5 Ground floor (normal)	16.6100	0.1600	2.6576
E20 Exposed floor (normal)	8.3000	0.3200	2.6560
E21 Exposed floor (inverted)	8.3000	0.3200	2.6560
E22 Basement floor	15.5800	0.0700	1.0906
E6 Intermediate floor within a dwelling	43.3000	0.0000	0.0000
E11 Eaves (insulation at rafter level)	24.7000	0.0400	0.9880
E13 Gable (insulation at rafter level)	4.8800	0.0800	0.3904
E14 Flat roof	23.4900	0.0800	1.8792
E16 Corner (normal)	33.3500	0.0900	3.0015
E17 Corner (inverted - internal area greater than external area)	18.0000	-0.0900	-1.6200
E18 Party wall between dwellings	18.0000	0.0600	1.0800
P1 Party wall - Ground floor	10.2200	0.0800	0.8176
P2 Party wall - Intermediate floor within a dwelling	26.2500	0.0000	0.0000
P4 Party wall - Roof (insulation at ceiling level)	4.5700	0.1200	0.5484
P5 Party wall - Roof (insulation at rafter level)	8.1400	0.0800	0.6512
R1 Head of roof window	1.1000	0.0800	0.0880
R2 Sill of roof window	1.1000	0.0600	0.0660
R3 Jamb of roof window	3.2800	0.0800	0.2624
R4 Ridge (vaulted ceiling)	9.6700	0.0800	0.7736
R5 Ridge (inverted)	12.9700	0.0400	0.5188

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

23.6263 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 110.4245 (37)

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

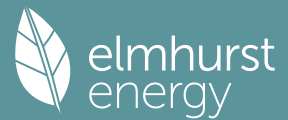
(38)m	Jan 115.9537	Feb 115.4083	Mar 114.8738	Apr 112.3631	May 111.8933	Jun 109.7065	Jul 109.7065	Aug 109.3016	Sep 110.5488	Oct 111.8933	Nov 112.8436	Dec 113.8371 (38)
Heat transfer coeff	226.3782	225.8328	225.2983	222.7876	222.3178	220.1311	220.1311	219.7261	220.9734	222.3178	223.2681	224.2616 (39)
Average = Sum(39)m / 12 =												222.7853

HLP	Jan 1.0706	Feb 1.0680	Mar 1.0655	Apr 1.0536	May 1.0514	Jun 1.0411	Jul 1.0411	Aug 1.0391	Sep 1.0450	Oct 1.0514	Nov 1.0559	Dec 1.0606 (40)
HLP (average)												1.0536
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.0168 (42)
Hot water usage for mixer showers	74.8019	73.6778	72.0397	68.9055	66.5926	64.0133	62.5471	64.1728	65.9549	68.7243	71.9258	74.5153 (42a)	
Hot water usage for baths	32.2905	31.8109	31.1356	29.8904	28.9581	27.9242	27.3658	28.0364	28.7665	29.8728	31.1436	32.1813 (42b)	
Hot water usage for other uses	45.5252	43.8697	42.2143	40.5588	38.9033	37.2479	37.2479	38.9033	40.5588	42.2143	43.8697	45.5252 (42c)	
Average daily hot water use (litres/day)												140.2897 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy content (annual)	152.6176	149.3584	145.3896	139.3548	134.4540	129.1854	127.1608	131.1125	135.2802	140.8114	146.9391	152.2218 (44)	
Distribution loss (46)m = 0.15 x (45)m	241.7089	212.6844	223.4583	190.7697	181.0010	158.8485	153.7900	162.3447	166.8140	191.0797	209.3417	238.3426 (45)	
										Total = Sum(45)m =		2330.1835	
Water storage loss:	36.2563	31.9027	33.5188	28.6155	27.1501	23.8273	23.0685	24.3517	25.0221	28.6620	31.4013	35.7514 (46)	
Store volume												200.0000 (47)	
a) If manufacturer declared loss factor is known (kWh/day):												1.6525 (48)	
Temperature factor from Table 2b												0.5400 (49)	
Enter (49) or (54) in (55)												0.8924 (55)	
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (56)	
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637 (57)	
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	292.6350	258.6821	274.3844	240.0530	231.9270	208.1318	204.7161	213.2708	216.0973	242.0058	258.6250	289.2686 (62)	

Full SAP Calculation Printout



WVHRS	-34.1963	-30.2435	-31.6692	-26.2234	-24.4393	-20.9128	-19.6025	-20.8452	-21.6372	-25.5079	-28.8974	-33.5630 (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	258.4387	228.4386	242.7152	213.8296	207.4878	187.2189	185.1136	192.4255	194.4601	216.4979	229.7276	255.7056 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											2612.0592 (64)
Electric shower(s)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Heat gains from water heating, kWh/month	121.1091	107.5158	115.0408	102.8576	100.9237	92.2438	91.8760	94.7205	94.8923	104.2749	109.0328	119.9898 (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	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	150.8406	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	206.7324	228.8823	206.7324	213.6235	206.7324	213.6235	206.7324	206.7324	213.6235	206.7324	213.6235	206.7324	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	381.8014	385.7633	375.7794	354.5249	327.6950	302.4786	285.6325	281.6706	291.6545	312.9089	339.7389	364.9553	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	38.0841	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	0.0000	0.0000	0.0000	0.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	-120.6725	(71)
Water heating gains (Table 5)	162.7810	159.9937	154.6247	142.8577	135.6501	128.1163	123.4893	127.3125	131.7949	140.1544	151.4344	161.2766	(72)
Total internal gains	822.5670	845.8915	808.3887	782.2583	741.3297	712.4706	684.1064	683.9677	705.3250	731.0479	776.0490	804.2164	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.4600	10.6334	0.6300	0.7000	0.7700	11.2440 (74)			
East				15.3000	19.6403	0.6300	0.7000	0.7700	91.8355 (76)			
Southwest				1.7500	36.7938	0.6300	0.7000	0.7700	19.6782 (79)			
West				6.1700	19.6403	0.6300	0.7000	0.7700	37.0343 (80)			
Northwest				1.7500	11.2829	0.6300	0.7000	0.7700	6.0344 (81)			
West				0.9000	25.5349	0.6300	0.7000	1.0000	9.1213 (82)			
Solar gains	174.9477	337.5799	550.5304	803.7668	991.8080	1019.6866	968.8839	826.6822	639.7382	398.5900	217.1545	144.5797 (83)
Total gains	997.5146	1183.4714	1358.9191	1586.0252	1733.1377	1732.1572	1652.9903	1510.6499	1345.0632	1129.6379	993.2034	948.7962 (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	64.8650	65.0217	65.1759	65.9104	66.0497	66.7058	66.7058	66.8288	66.4516	66.0497	65.7686	65.4772
alpha	5.3243	5.3348	5.3451	5.3940	5.4033	5.4471	5.4471	5.4553	5.4301	5.4033	5.3846	5.3651
util living area	0.9994	0.9983	0.9946	0.9756	0.9079	0.7464	0.5723	0.6424	0.8922	0.9892	0.9985	0.9995 (86)
MIT	19.5681	19.7368	20.0139	20.4074	20.7450	20.9400	20.9883	20.9791	20.8322	20.3833	19.9108	19.5471 (87)
Th 2	20.0249	20.0270	20.0291	20.0389	20.0407	20.0493	20.0493	20.0508	20.0460	20.0407	20.0370	20.0331 (88)
util rest of house	0.9992	0.9977	0.9926	0.9658	0.8709	0.6608	0.4557	0.5230	0.8344	0.9834	0.9979	0.9994 (89)
MIT 2	18.3331	18.5508	18.9064	19.4100	19.8122	20.0128	20.0453	20.0428	19.9189	19.3863	18.7812	18.3121 (90)
Living area fraction	18.4745	18.6866	19.0332	19.5242	19.9190	20.1189	20.1533	20.1500	20.0235	19.5005	18.9106	18.4535 (92)
MIT	18.4745	18.6866	19.0332	19.5242	19.9190	20.1189	20.1533	20.1500	20.0235	19.5005	18.9106	18.4535 (93)
Temperature adjustment	18.4745	18.6866	19.0332	19.5242	19.9190	20.1189	20.1533	20.1500	20.0235	19.5005	18.9106	18.4535 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9986	0.9964	0.9895	0.9587	0.8652	0.6676	0.4689	0.5362	0.8328	0.9787	0.9967	0.9990 (94)
Ext temp.	996.1475	1179.2510	1344.6424	1520.5950	1499.5908	1156.4001	775.1328	809.9729	1120.1120	1105.5252	989.9732	947.8092 (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	3208.7972	3113.4646	2823.7121	2366.9302	1827.2335	1214.8875	782.1860	823.9743	1308.9345	1978.7306	2636.9250	3196.5110 (97)
Space heating requirement - total per year (kWh/year)	1646.2113	1299.7916	1100.4278	609.3614	243.7662	0.0000	0.0000	0.0000	0.0000	649.6648	1185.8053	1673.0341 (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)
Space heating contribution - total per year (kWh/year)	1646.2113	1299.7916	1100.4278	609.3614	243.7662	0.0000	0.0000	0.0000	0.0000	649.6648	1185.8053	1673.0341 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)	1646.2113	1299.7916	1100.4278	609.3614	243.7662	0.0000	0.0000	0.0000	0.0000	649.6648	1185.8053	1673.0341 (98c)
Space heating per m2	(98c) / (4) =											39.7638 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.3000 (206)
Efficiency of main space heating system 2 (in %)	0.0000 (207)

Full SAP Calculation Printout



Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1646.2113	1299.7916	1100.4278	609.3614	243.7662	0.0000	0.0000	0.0000	0.0000	649.6648	1185.8053	1673.0341 (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)	1783.5442	1408.2249	1192.2295	660.1965	264.1021	0.0000	0.0000	0.0000	0.0000	703.8622	1284.7295	1812.6047 (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	258.4387	228.4386	242.7152	213.8296	207.4878	187.2189	185.1136	192.4255	194.4601	216.4979	229.7276	255.7056 (64)
Efficiency of water heater (217)m	87.4616	87.3278	87.0264	86.2726	84.4221	79.8000	79.8000	79.8000	79.8000	86.3654	87.2039	79.8000 (216)
Fuel for water heating, kWh/month	295.4883	261.5876	278.8985	247.8536	245.7743	234.6102	231.9719	241.1348	243.6843	250.6767	263.4374	292.2623 (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	42.9549	34.4600	31.0274	22.7320	17.5589	14.3457	16.0178	20.8205	27.0438	35.4829	40.0779	44.1488 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-42.6765	-62.2996	-92.6407	-107.7971	-119.2755	-112.3072	-110.8256	-103.0889	-90.0197	-72.7650	-47.6350	-36.6437 (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	-18.0145	-38.4672	-77.5692	-118.1896	-157.9978	-159.4943	-157.7243	-132.8354	-96.3637	-55.6751	-24.2541	-14.2105 (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												9109.4936 (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												3087.3799 (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)												346.6707 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-2048.7701 (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												10580.7741 (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	9109.4936	0.2100	1912.9937 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3087.3799	0.2100	648.3498 (264)
Space and water heating			2561.3434 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	346.6707	0.1443	50.0353 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-997.9745	0.1339	-133.6263
PV Unit electricity exported	-1050.7956	0.1255	-131.8312
Total			-265.4575 (269)
Total CO2, kg/year			2357.8505 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1500 (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	9109.4936	1.1300	10293.7277 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3087.3799	1.1300	3488.7393 (278)
Space and water heating			13782.4670 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	346.6707	1.5338	531.7352 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-997.9745	1.4948	-1491.7961
PV Unit electricity exported	-1050.7956	0.4605	-483.8876
Total			-1975.6837 (283)
Total Primary energy kWh/year			12468.6192 (286)
Target Primary Energy Rate (TPER)			58.9700 (287)