

Energy Statement

41 Sheldon Avenue
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Job number: 12434

Date: September 2024

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1 Executive Summary

This report has been produced by Base Energy on behalf of GMS-ED Ltd and in support of the planning application for the development named as 41 Sheldon Avenue, London, N6 4JP comprising the construction of one new bespoke dwelling falling under the requirements of Haringey Council.

- 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 were feasible
- 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
- A design which limits thermal bridging
- Energy saving building services including MVHR, low energy lighting and heating controls
- Low carbon Air Source Heat Pumps
- Solar PV Panels – 5.9kWp in total

Table 1.1: Carbon emissions summary - New Build (Full demolition)

	Total CO2 Emission (Tonnes CO2/year)	CO2 saving (Tonnes CO2/year)	Percentage savings (%)
Part L Baseline	9.3	NA	N/A
Be Lean Design	7.1	2.2	24%
Be Clean	7.1	2.2	24%
Be Green	1.9	5.2	56%
Cumulative saving	NA	7.4	80%

This results in an 80% saving in CO2 emissions over Part L building regulations.

Table 1.2: Carbon emissions summary – Retained Front Facade (0.30 u-value)

	Total CO2 Emission (Tonnes CO2/year)	CO2 saving (Tonnes CO2/year)	Percentage savings (%)
Part L Baseline	8.7	NA	N/A
Be Lean Design	7.0	1.7	19%
Be Clean	7.0	1.7	19%
Be Green	2.0	5.1	58%
Cumulative saving	NA	6.8	77%

This results in an 77% saving in CO2 emissions over Part L building regulations.

For the carbon off set contribution, please see the GLA spreadsheet provided.

2 Existing and Proposed Development

The development site is located at 41 Sheldon Avenue, London, N6 4JP.

The development proposals are for the construction of one new bespoke 5-bedroom dwelling over 4 storeys.

The development proposals constitute a minor development.

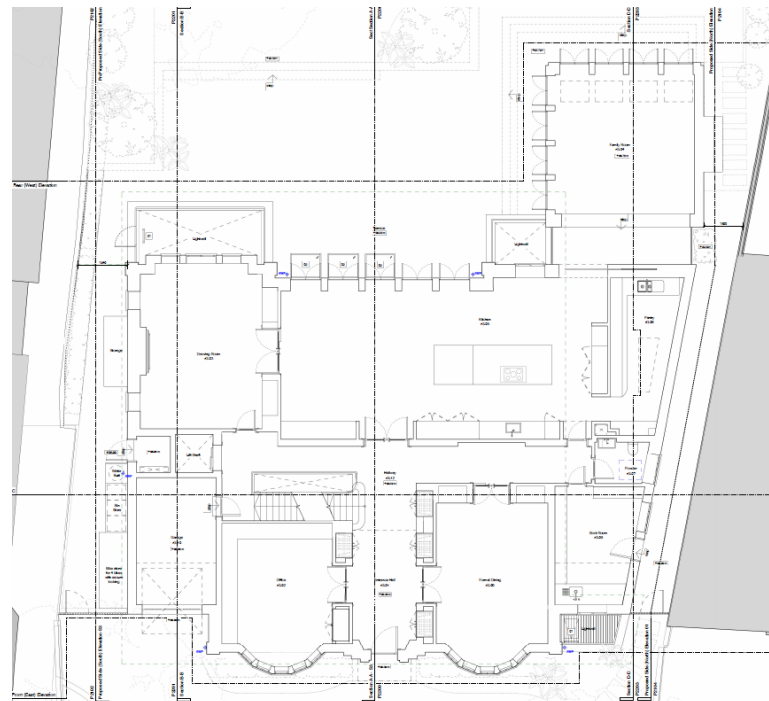
Aspects of the site location, shape, and surroundings (in particular the adjacent buildings), along with any other requirements of planning, use type, and scale will naturally constrain the development proposals in terms of the layout, positioning, and orientation of the proposed development. Subsequently, 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

Key Site Plan



Scale: 1:1250 @A1



3 Planning Policy

National Planning Policy Framework 2023

The NPPF was updated in December 2023 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 where feasible
 - 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 – New Build

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	10.7	870	9,274

The **Total Baseline CO2 Emissions** for the development are shown to be 9,274 kg/year.

Table 5.2: Baseline CO2 – Retained Front Facade (0.30 u-value)

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	10.04	870	8,735

The **Total Baseline CO2 Emissions** for the development are shown to be 8,735 kg/year.

Table 5.3: Baseline Energy Demand – New Build

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)
Baseline	56.93	870	49,529

The **Baseline Energy Demand** for the development is shown to be 49,529 kWh per year.

Table 5.4: Baseline Energy Demand – Retained Front Facade (0.30 u-value)

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)
Baseline	53.61	870	46,640

The **Baseline Energy Demand** for the development is shown to be 46,640 kWh per 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 standards as set out below.

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

	Part L 2013 Limiting Parameters	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development Full Demolition	Proposed Development Retained Facade
New external walls	0.30	0.26	0.18	0.13	0.13
Wall to garage	0.30	0.26	0.18	0.25 (0.21 with shelter factor applied)	0.25 (0.21 with shelter factor applied)
Dormer walls	0.30	0.26	0.18	0.26	0.26
Retained front facade	0.30	0.26	0.18	n/a	0.30
Ground floor	0.25	0.18	0.13	0.11	0.11
Exposed floor to garage	0.25	0.18	0.13	0.17 (0.15 with shelter factor applied)	0.17 (0.15 with shelter factor applied)
Roofs	0.20	0.16	0.11	0.11	0.11
Dormer roof	0.20	0.16	0.11	0.16	0.16
Windows	2.00	1.6	1.2	1.2, G-value 0.40	1.2, G-value 0.40
Doors	2.00	1.6	1.0	1.00	1.00
Air permeability	10.00	8.00	5.00	3.00	3.00

- Insulation: The specified building envelope is designed to 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 by targeting a global 'y-value' of 0.047 for new build and 0.053 for retained facade.

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

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Space & Water Heating: Condensing gas boiler 89.5% efficiency for new build GLA baseline
- Heating Controls: Comprising time & temperature zone control
- Ventilation: MVHR to basement, Model: Titon 1.65 Q Plus (SFP 1.05 and 83% efficiency)
- Air tightness test 3.0@50Pa

The specifications outlined above and with the heating provided by a gas boiler as required by the GLA guidance, have been incorporated into the calculation to generate a dwelling emission rate to be measured against the baseline data.

Table 6.1: Average Baseline vs Average Be Lean CO2 – New Build

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Total Baseline Emissions (kg CO2/year) minus notional Solar PV	Reduction in CO2
Baseline	10.7	870	9,274	N/A	N/A
Be Lean	9.94	870	8,648	7,092	24%

The CO2 Emissions reduction as a result of energy efficient fabric and services is shown to be 2,182 kg/year.

Table 6.2: Average Baseline vs Average Be Lean CO2 - Retained Front Facade (0.30 u-value)

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Total Baseline Emissions (kg CO2/year) minus notional Solar PV	Reduction in CO2
Baseline	10.04	870	8,735	N/A	N/A
Be Lean	9.88	870	8,596	7,039	19%

The CO2 Emissions reduction as a result of energy efficient fabric and services is shown to be 1,696 kg/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:

- Comply 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)

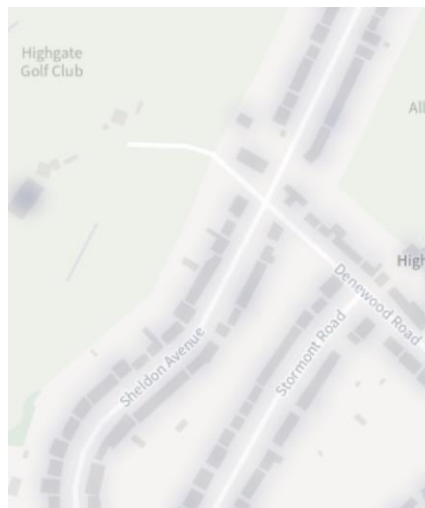
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating 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 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 350 Watts to 450 Watts 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 Air Source Heat Pump and Solar PV would be potentially feasible. The following low carbon technology is recommended:

ASHP/VRV System – Model: Daikin RYQ22U, Commercial unit with a SCOP of 4.5.

The heat recovery VRV system recovers heat from parts of the dwelling which are being cooled, and then uses this heat recovery to provide heating and hot water to the house. Due to the VRV being a commercial scale heating system, for the purpose of the report we can only include a domestic unit with specifications as close to the commercial unit as possible, the model used has an efficiency of 370%.

Solar PV – 5.31kW in total

- 2.73kWp displayed at 45° angle on South-west pitch with none or little overshadowing.
- 3.18kWp displayed horizontal on flat roof with none or little overshadowing.

These technologies are 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 selected Low Carbon Technology has been incorporated into the calculation and the results are set out below.

Table 8.1: Baseline vs Be Green CO2 – New Build

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	10.7	870	9,274	N/A
Be Lean & Green Design	2.17	870	1,888	80%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 7,386 kg/year.

Table 8.2: Baseline vs Be Green CO2 – Retained Front Facade (0.30 u-value)

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	10.04	870	8,735	N/A
Be Lean & Green Design	2.28	870	1,984	77%

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 6,751 kg/year.

Table 8.3: Baseline vs Be Green Energy Demand - New Build

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)	Reduction in Energy Demand
Baseline	56.93	870	49,529	N/A
Be Lean & Green Design	24.25	870	21,097	57%

The **Energy Demand reduction** as a result of energy efficient fabric and services is shown to be 28,432 kWh per year

Table 8.4: Baseline vs Be Green Energy Demand - Retained Front Facade (0.30 u-value)

	Energy Demand (kWh/m ² /year)	Floor Area (m ²)	Total Baseline Energy Demand (kWh/year)	Reduction in Energy Demand
Baseline	53.61	870	46,640	N/A
Be Lean & Green Design	25.28	870	21,993	53%

The **Energy Demand reduction** as a result of energy efficient fabric and services is shown to be 24,647 kWh per year

Table 8.5: Fabric Efficiency – New Build

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	51.4	49.37	4%

Table 8.6: Fabric Efficiency – Retained Front Facade (0.30 u-value)

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	53.79	50.22	7%

Table 8.7: Renewables CO2 Reduction (Solar PV) – New Build

	CO2 Emission Rate (kg CO ₂ /m ² /year)	Solar PV Emissions (kg CO ₂ /year)	Total CO2 Emission Rate (kg CO ₂ /m ² /year)	Improvement (%)
Development total	2,454.74	-589.86	1,864.88	24%

Table 8.7: Renewables CO2 Reduction (Solar PV) – Retained Front Facade (0.30 u-value)

	CO2 Emission Rate (kg CO ₂ /m ² /year)	Solar PV Emissions (kg CO ₂ /year)	Total CO2 Emission Rate (kg CO ₂ /m ² /year)	Improvement (%)
Development total	2,571.18	-589.80	1,981.39	22%

Table 8.7: Renewables Total Energy Reduction (Solar PV) – New Build

	Energy (kWh/m2/year)	Solar PV Energy (kWh/m2/year)	Total Energy (kWh/m2/year)	Improvement (%)
Development total	16,613	-4,611	12,002	27%

Table 8.7: Renewables Total Energy Reduction (Solar PV) – Retained Front Facade (0.30 u-value)

	Energy (kWh/m2/year)	Solar PV Energy (kWh/m2/year)	Total Energy (kWh/m2/year)	Improvement (%)
Development total	17,385	-4,611	12,774	26%

Table 8.8: Space heating demand – New Build

	Space heating demand (kWh/m2/year)
Be Lean/Green	36.43

Table 8.9: Space heating demand - Retained Front Facade (0.30 u-value)

	Space heating demand (kWh/m2/year)
Be Lean/Green	39.32

9 Zero Carbon Standard Summary – New Build

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 80% 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	24%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	5.2	56%
Cumulative on site savings	7.4	80%
Annual savings from off-set payment	1.9	-
(Tonnes CO₂)		
Cumulative savings for off-set payment	57	-
Cash in-lieu contribution (£)	5,381	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

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

9 Zero Carbon Standard Summary – Retained Front Facade (0.30 u-value)

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 77% 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	1.7	19%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	5.1	58%
Cumulative on site savings	6.8	77%
Annual savings from off-set payment	2.0	-
(Tonnes CO₂)		
Cumulative savings for off-set payment	60	-
Cash in-lieu contribution (£)	5,653	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

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

10 Conclusion

Proposals are for the development named as 41 Sheldon Avenue, London, N6 4JP comprising the construction of one new bespoke dwelling falling under the requirements of Haringey Council.

The Haringey Local Planning Policy requirements are as follows.

- 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.

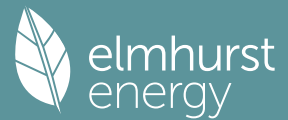
Low and zero carbon technology will be incorporated and is to comprise ASHP/VRV system along with Solar PV, 5.9kWp for the total development.

This results in a total 80% saving in CO2 over Part L 2021 for the new build calculation and 77% saving in CO2 over Part L 2021 for the retained front facade calculation

This Energy Statement and the calculations on which it is based demonstrate that the proposed development complies with the local planning policy requirements.

11 Appendix 1 - Be Lean DER/TER SAP Worksheets

Full SAP Calculation Printout



Property Reference	12434				Issued on Date	30/09/2024		
Assessment Reference	Be Lean New Build			Prop Type Ref	Detached House			
Property	41, Sheldon Avenue, London, N6 4JP							
SAP Rating	84 B		DER	9.91		TER	10.66	
Environmental	88 B		% DER < TER				7.04	
CO ₂ Emissions (t/year)	7.77		DFEE	49.77		TFEE	53.41	
Compliance Check	See BREL		% DFEE < TFEE				6.81	
% DPER < TPER	-3.26		DPER	58.79		TPER	56.93	
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	243.6000 (1a)	x	2.9000 (2a)	=	706.4400 (1a)	- (3a)
Ground floor	298.1000 (1b)	x	3.8500 (2b)	=	1147.6850 (1b)	- (3b)
First floor	222.8000 (1c)	x	3.2200 (2c)	=	717.4160 (1c)	- (3c)
Second floor	106.3000 (1d)	x	2.6900 (2d)	=	285.9470 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000				(4)	
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2857.4880 (5)	

2. Ventilation rate

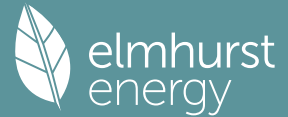
											m3 per hour		
Number of open chimneys											0 * 80 =	0.0000 (6a)	
Number of open flues											0 * 20 =	0.0000 (6b)	
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)	
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)	
Number of flues attached 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											3.0000 (17)		
Infiltration rate											0.1500 (18)		
Number of sides sheltered											0 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] = 1.0000 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) = 0.1500 (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													
	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (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) =													74.7000 (23c)
Effective ac	0.3177	0.3140	0.3103	0.2915	0.2877	0.2690	0.2690	0.2652	0.2765	0.2877	0.2953	0.3027 (25)	

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
Windows (Uw = 1.20)			101.4800	1.1450	116.1985			(27)
Door			7.8500	1.0000	7.8500			(26)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438			(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897			(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247			(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983			(27a)
Basement floor			241.5100	0.1100	26.5661	110.0000	26566.1000	(28)
Ground floor			102.9200	0.1100	11.3212	110.0000	11321.2000	(28a)
Exposed floor to garage			10.8400	0.1524	1.6518	20.0000	216.8000	(28b)
Basement Wall	189.0000		189.0000	0.1300	24.5700	9.0000	1701.0000	(29a)
External Wall	530.0000	103.0500	426.9500	0.1300	55.5035	150.0000	64042.5000	(29a)
Stud Wall	231.0000		231.0000	0.0800	18.4800	18.0000	4158.0000	(29a)

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Heat gains from water heating, kWh/month
151.4741 134.3752 143.4715 127.4724 124.5528 113.2712 112.3791 116.1483 116.6886 128.9065 135.6417 149.9619 (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	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	(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)	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	(71)
Water heating gains (Table 5)	203.5943	199.9630	192.8380	177.0450	167.4097	157.3211	151.0472	156.1134	162.0675	173.2615	188.3913	201.5617	(72)
Total internal gains	1587.5424	1642.1707	1563.5820	1516.6076	1432.7206	1379.7634	1321.1292	1317.5082	1360.7762	1406.1516	1495.5331	1548.5720	(73)

6. Solar gains

[Jan]												
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
Northeast					5.8300	11.2829	0.4000	0.0000	0.7700			20.2601 (75)
East					1.8000	19.6403	0.4000	0.0000	0.7700			10.8886 (76)
Southeast					24.3800	36.7938	0.4000	0.0000	0.7700			276.2864 (77)
South					1.8000	46.7521	0.4000	0.0000	0.7700			25.9193 (78)
Southwest					14.1600	36.7938	0.4000	0.0000	0.7700			160.4682 (79)
Northwest					53.5100	11.2829	0.4000	0.0000	0.7700			185.9551 (81)
Horizontal					7.7000	26.0000	0.4000	0.0000	1.0000			80.0800 (82)
Solar gains	759.8576	1393.7811	2159.0110	3077.5254	3799.9437	3923.8196	3720.2779	3160.7323	2475.1907	1609.5447	928.5434	638.2075 (83)
Total gains	2347.4000	3035.9518	3722.5930	4594.1329	5232.6643	5303.5830	5041.4071	4478.2406	3835.9669	3015.6962	2424.0764	2186.7795 (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	72.1182	72.4744	72.8342	74.6879	75.0701	77.0409	77.0409	77.4476	76.2403	75.0701	74.3097	73.5645	
alpha	5.8079	5.8316	5.8556	5.9792	6.0047	6.1361	6.1361	6.1632	6.0827	6.0047	5.9540	5.9043	
util living area	0.9999	0.9997	0.9984	0.9876	0.9292	0.7575	0.5783	0.6651	0.9297	0.9968	0.9998	1.0000	(86)
MIT	19.5640	19.7376	20.0160	20.4218	20.7658	20.9560	20.9928	20.9845	20.8306	20.3744	19.9126	19.5597	(87)
Th 2	20.2307	20.2342	20.2377	20.2553	20.2588	20.2765	20.2765	20.2800	20.2694	20.2588	20.2518	20.2447	(88)
util rest of house	0.9999	0.9996	0.9978	0.9831	0.9041	0.6909	0.4879	0.5717	0.8945	0.9953	0.9997	1.0000	(89)
MIT 2	18.4936	18.7189	19.0784	19.6086	20.0315	20.2459	20.2734	20.2725	20.1217	19.5535	18.9565	18.4984	(90)
Living area fraction									FLA = Living area / (4) =			0.0461	(91)
MIT	18.5430	18.7659	19.1216	19.6461	20.0653	20.2787	20.3065	20.3053	20.1544	19.5914	19.0006	18.5474	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3930	18.6159	18.9716	19.4961	19.9153	20.1287	20.1565	20.1553	20.0044	19.4414	18.8506	18.3974	(93)

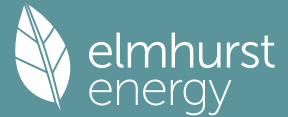
8. Space heating requirement

Utilisation	0.9998	0.9993	0.9964	0.9767	0.8898	0.6761	0.4725	0.5546	0.8779	0.9927	0.9995	0.9999	(94)
Useful gains	2347.0320	3033.7183	3709.2870	4487.0661	4655.7944	3585.6989	2382.0316	2483.7039	3367.6995	2993.5424	2422.8744	2186.5650	(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	10138.7919	9819.0262	8884.1689	7360.8031	5677.8836	3723.2904	2395.1622	2515.7599	4018.0992	6110.5709	8204.3279	10013.0776	(97)
Space heating kWh	5797.0694	4559.7269	3850.1122	2069.0906	760.4344	0.0000	0.0000	0.0000	0.0000	2319.0692	4162.6466	5822.9254	(98a)
Space heating requirement - total per year (kWh/year)												29341.0747	
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	5797.0694	4559.7269	3850.1122	2069.0906	760.4344	0.0000	0.0000	0.0000	0.0000	2319.0692	4162.6466	5822.9254	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												29341.0747	
Space heating per m2										(98c) / (4) =		33.6944	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	6330.4513	4983.5468	5091.3626	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8212	0.9004	0.8434	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5198.3218	4486.9976	4293.9259	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	5818.6853	5529.0876	4899.8776	0.0000	0.0000	0.0000	0.0000	(103)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	446.6618	775.3149	450.8280	0.0000	0.0000	0.0000	0.0000	(104)
Intermittency factor (Table 10b)									fc = cooled area / (4) =			0.1837	(105)
Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	(106)

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0.0000	0.0000	0.0000	0.0000	0.0000	20.5173	35.6139	20.7087	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement											76.8399 (107)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												5.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	5797.0694	4559.7269	3850.1122	2069.0906	760.4344	0.0000	0.0000	0.0000	0.0000	2319.0692	4162.6466	5822.9254 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	6477.1725	5094.6669	4301.8013	2311.8331	849.6473	0.0000	0.0000	0.0000	0.0000	2591.1388	4651.0018	6506.0619 (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	378.3697	334.4144	354.3016	308.6740	297.4033	265.9636	260.7907	272.1267	276.2416	310.4972	333.2435	373.8215 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	422.7594	373.6473	395.8677	344.8872	332.2942	297.1660	291.3862	304.0522	308.6499	346.9242	372.3391	417.6777 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	4.1035	7.1228	4.1417	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	438.7238	396.2667	438.7238	424.5714	438.7238	424.5714	438.7238	438.7238	424.5714	438.7238	424.5714	438.7238 (231)
Lighting	125.7565	100.8865	90.8371	66.5512	51.4060	41.9992	46.8943	60.9550	79.1745	103.8812	117.3336	129.2516 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	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)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												32783.3236 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												89.5000
Water heating fuel used												4207.6510 (219)
Space cooling fuel												15.3680 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4700)												
mechanical ventilation fans (SFP = 1.4700)												5124.6190 (230a)
central heating pump												41.0000 (230c)
Total electricity for the above, kWh/year												5165.6190 (231)
Electricity for lighting (calculated in Appendix L)												1014.9267 (232)
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												43186.8883 (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	32783.3236	0.2100	6884.4980 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	4207.6510	0.2100	883.6067 (264)
Space and water heating			7768.1047 (265)
Space cooling	15.3680	0.1137	1.7469 (266)
Pumps, fans and electric keep-hot	5165.6190	0.1387	716.5350 (267)
Energy for lighting	1014.9267	0.1443	146.4853 (268)
Total CO2, kg/year			8632.8719 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.9100 (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	32783.3236	1.1300	37045.1557 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4207.6510	1.1300	4754.6457 (278)
Space and water heating			41799.8014 (279)
Space cooling	15.3680	1.4191	21.8085 (280)
Pumps, fans and electric keep-hot	5165.6190	1.5128	7814.5484 (281)
Energy for lighting	1014.9267	1.5338	1556.7284 (282)

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Total Primary energy kWh/year
Dwelling Primary energy Rate (DPER)

51192.8867 (286)
58.7900 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	243.6000 (1a)	x 2.9000 (2a)	= 706.4400 (1a) - (3a)
Ground floor	298.1000 (1b)	x 3.8500 (2b)	= 1147.6850 (1b) - (3b)
First floor	222.8000 (1c)	x 3.2200 (2c)	= 717.4160 (1c) - (3c)
Second floor	106.3000 (1d)	x 2.6900 (2d)	= 285.9470 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2857.4880 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0140 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2640 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2640 (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	0.3366	0.3300	0.3234	0.2904	0.2838	0.2508	0.2508	0.2442	0.2640	0.2838	0.2970	0.3102 (22b)
Effective ac	0.5566	0.5544	0.5523	0.5422	0.5403	0.5314	0.5314	0.5298	0.5348	0.5403	0.5441	0.5481 (25)

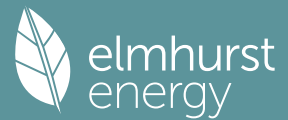
3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			7.8500	1.0000	7.8500		(26)
TER Opening Type (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1300	31.3963		(28a)
Ground floor			102.9200	0.1300	13.3796		(28a)
Exposed floor to garage			10.8400	0.1300	1.4092		(28b)
Basement Wall	189.0000		189.0000	0.1800	34.0200		(29a)
External Wall	530.0000	103.0500	426.9500	0.1800	76.8510		(29a)
Stud Wall	231.0000		231.0000	0.1800	41.5800		(29a)
Dormer Walls	7.2000	6.2800	0.9200	0.1800	0.1656		(29a)
Wall to garage	38.5400		38.5400	0.1800	6.9372		(29a)
Pitch Roof	182.0000		182.0000	0.1100	20.0200		(30)
Flat Roof	103.2800	4.2800	99.0000	0.1100	10.8900		(30)
Flat Blue Roof	29.3200		29.3200	0.1100	3.2252		(30)
Dormer Roof	8.8500		8.8500	0.1100	0.9735		(30)
Ceiling to loft void	125.9100		125.9100	0.1100	13.8501		(30)
Basement ceiling to garage	23.6400		23.6400	0.1100	2.6004		(30)
Basement ceiling garden rear	23.1700	3.4200	19.7500	0.1100	2.1725		(30)
Total net area of external elements Aum(A, m ²)			1847.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	395.7756		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							214.4927 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	59.0500	0.0500	2.9525
E2 Other lintels (including other steel lintels)	55.8000	0.0500	2.7900
E3 Sill	199.5000	0.0500	9.9750
E4 Jamb	65.2000	0.1600	10.4320
E5 Ground floor (normal)	14.1300	0.0700	0.9891
E19 Ground floor (inverted)	6.6100	0.3200	2.1152
E20 Exposed floor (normal)	6.6100	0.3200	2.1152
E21 Exposed floor (inverted)	65.2000	0.0700	4.5640
E22 Basement floor	219.1600	0.0000	0.0000
E6 Intermediate floor within a dwelling	8.9500	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	50.4300	0.0400	2.0172
E11 Eaves (insulation at rafter level)			

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E14 Flat roof	96.8000	0.0800	7.7440
E16 Corner (normal)	99.9700	0.0900	8.9973
E17 Corner (inverted - internal area greater than external area)	72.5900	-0.0900	-6.5331
R1 Head of roof window	5.5000	0.0800	0.4400
R2 Sill of roof window	5.5000	0.0600	0.3300
R3 Jamb of roof window	11.6000	0.0800	0.9280
R4 Ridge (vaulted ceiling)	2.9700	0.0800	0.2376
R5 Ridge (inverted)	13.0000	0.0400	0.5200
R6 Flat ceiling	35.7500	0.0600	2.1450
R7 Flat ceiling (inverted)	6.6000	0.0400	0.2640
R9 Roof to wall (flat ceiling)	6.6000	0.0400	0.2640
Thermal bridges (Sum(L x Psi) calculated using Appendix K)			53.2870 (36)
Point Thermal Bridges			0.0000
Total fabric heat loss	(33) + (36) + (36a) =		449.0626 (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	524.9039	522.8296	520.7964	511.2464	509.4596	501.1419	501.1419	499.6016	504.3458	509.4596	513.0743	516.8532 (38)
Average = Sum(39)m / 12 =	973.9666	971.8923	969.8590	960.3090	958.5223	950.2045	950.2045	948.6642	953.4084	958.5223	962.1369	965.9158 (39)
												960.3005
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1185	1.1161	1.1138	1.1028	1.1007	1.0912	1.0912	1.0894	1.0949	1.1007	1.1049	1.1092 (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												3.8740 (42)
Hot water usage for mixer showers	89.1739	87.8337	85.8809	82.1446	79.3873	76.3123	74.5646	76.5026	78.6270	81.9286	85.7451	88.8322 (42a)
Hot water usage for baths	38.4709	37.8995	37.0950	35.6115	34.5007	33.2689	32.6036	33.4026	34.2725	35.5905	37.1045	38.3408 (42b)
Hot water usage for other uses	54.3033	52.3287	50.3540	48.3793	46.4047	44.4300	44.4300	46.4047	48.3793	50.3540	52.3287	54.3033 (42c)
Average daily hot water use (litres/day)												167.2505 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	181.9481	178.0619	173.3299	166.1354	160.2926	154.0113	151.5982	156.3098	161.2788	167.8730	175.1783	181.4764 (44)
Energy content (annual)	288.1613	253.5578	266.4016	227.4311	215.7846	189.3748	183.3448	193.5442	198.8729	227.8021	249.5736	284.1481 (45)
Distribution loss (46)m = 0.15 x (45)m	43.2242	38.0337	39.9602	34.1147	32.3677	28.4062	27.5017	29.0316	29.8309	34.1703	37.4360	42.6222 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (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	334.7562	295.6436	312.9965	272.5229	262.3795	234.4667	229.9397	240.1391	243.9647	274.3970	294.6655	330.7430 (62)
WWHRS	-40.7666	-36.0543	-37.7540	-31.2618	-29.1349	-24.9309	-23.3687	-24.8503	-25.7945	-30.4088	-34.4495	-40.0116 (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	293.9896	259.5893	275.2425	241.2611	233.2447	209.5358	206.5710	215.2888	218.1703	243.9881	260.2159	290.7314 (64)
Total per year (kWh/year)												2947.8285 (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	133.0895	117.9766	125.8545	111.6943	109.0243	99.0406	98.2381	101.6294	102.1987	113.0201	119.0567	131.7552 (65)

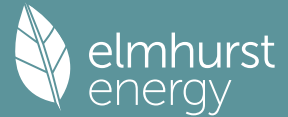
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588 (71)
Water heating gains (Table 5)	178.8838	175.5604	169.1592	155.1310	146.5381	137.5564	132.0404	136.5986	141.9426	151.9088	165.3565	177.0903 (72)
Total internal gains	1562.8319	1617.7680	1539.9032	1494.6935	1411.8490	1359.9987	1302.1224	1297.9935	1340.6513	1384.7989	1472.4983	1524.1006 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	5.8300	11.2829	0.6300	0.7000	0.7700	20.1031 (75)
East	1.8000	19.6403	0.6300	0.7000	0.7700	10.8042 (76)
Southeast	24.3800	36.7938	0.6300	0.7000	0.7700	274.1451 (77)
South	1.8000	46.7521	0.6300	0.7000	0.7700	25.7185 (78)

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Southwest			14.1600		36.7938		0.6300		0.7000		0.7700		159.2246 (79)
Northwest			53.5100		11.2829		0.6300		0.7000		0.7700		184.5139 (81)
Horizontal			7.7000		26.0000		0.6300		0.7000		1.0000		79.4594 (82)

Solar gains	753.9687	1382.9793	2142.2787	3053.6745	3770.4941	3893.4100	3691.4457	3136.2367	2456.0080	1597.0707	921.3472	633.2614	(83)
Total gains	2316.8007	3000.7473	3682.1819	4548.3681	5182.3431	5253.4087	4993.5681	4434.2301	3796.6593	2981.8695	2393.8454	2157.3620	(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	53.2702	53.3839	53.4958	54.0278	54.1285	54.6023	54.6023	54.6910	54.4189	54.1285	53.9252	53.7142	
alpha	4.5513	4.5589	4.5664	4.6019	4.6086	4.6402	4.6402	4.6461	4.6279	4.6086	4.5950	4.5809	
util living area	0.9999	0.9996	0.9984	0.9918	0.9639	0.8771	0.7428	0.8162	0.9652	0.9973	0.9997	0.9999	(86)
MIT	19.0531	19.2338	19.5489	20.0046	20.4510	20.7932	20.9338	20.8955	20.5913	20.0201	19.4631	19.0324	(87)
Th 2	19.9858	19.9877	19.9896	19.9986	20.0002	20.0080	20.0080	20.0095	20.0050	20.0002	19.9968	19.9933	(88)
util rest of house	0.9998	0.9994	0.9978	0.9885	0.9468	0.8135	0.6150	0.7033	0.9410	0.9959	0.9996	0.9999	(89)
MIT 2	17.6645	17.8976	18.3028	18.8914	19.4521	19.8522	19.9779	19.9544	19.6348	18.9144	18.1980	17.6430	(90)
Living area fraction	17.7285	17.9592	18.3603	18.9427	19.4982	19.8956	20.0220	19.9978	19.6789	18.9654	18.2563	17.7071	(91)
MIT	17.7285	17.9592	18.3603	18.9427	19.4982	19.8956	20.0220	19.9978	19.6789	18.9654	18.2563	17.7071	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7285	17.9592	18.3603	18.9427	19.4982	19.8956	20.0220	19.9978	19.6789	18.9654	18.2563	17.7071	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9997	0.9989	0.9962	0.9831	0.9350	0.8045	0.6171	0.7016	0.9293	0.9934	0.9992	0.9998	(94)
Useful gains	2316.0778	2997.5488	3668.3678	4471.5933	4845.2823	4226.5364	3081.5429	3111.2773	3528.1341	2962.1729	2391.9609	2156.8887	(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	13078.9270	12692.1270	11502.8251	9644.1169	7474.7610	5031.9322	3251.6331	3413.1117	5318.9555	8018.3953	10733.9288	13046.6992	(97)
Space heating kWh	8007.5598	6514.7566	5828.8362	3724.2170	1956.3321	0.0000	0.0000	0.0000	0.0000	3761.8294	6006.2169	8102.0190	(98a)
Space heating requirement - total per year (kWh/year)												43901.7670	
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	8007.5598	6514.7566	5828.8362	3724.2170	1956.3321	0.0000	0.0000	0.0000	0.0000	3761.8294	6006.2169	8102.0190	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43901.7670	
Space heating per m2										(98c) / (4) =		50.4154	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	8007.5598	6514.7566	5828.8362	3724.2170	1956.3321	0.0000	0.0000	0.0000	0.0000	3761.8294	6006.2169	8102.0190	(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)	8675.5794	7058.2411	6315.0988	4034.9047	2119.5364	0.0000	0.0000	0.0000	0.0000	4075.6549	6507.2772	8777.9187	(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	293.9896	259.5893	275.2425	241.2611	233.2447	209.5358	206.5710	215.2888	218.1703	243.9881	260.2159	290.7314	(64)
Efficiency of water heater (217)m	88.4467	88.4179	88.3507	88.1948	87.7458	79.8000	79.8000	79.8000	79.8000	88.1942	88.3861	88.4544	(216)
Fuel for water heating, kWh/month	332.3917	293.5936	311.5341	273.5547	265.8186	262.5761	258.8609	269.7854	273.3963	276.6489	294.4083	328.6793	(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	96.1349	77.1230	69.4407	50.8752	39.2975	32.1064	35.8485	46.5972	60.5252	79.4123	89.6960	98.8068	(232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-197.6255	-264.4063	-360.4289	-382.9514	-394.1361	-360.2710	-354.7627	-343.2823	-321.5254	-290.3090	-211.6789	-172.4735	(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	-159.0528	-327.7963	-639.8878	-945.1630	-1235.3883	-1237.0952	-1223.4945	-1043.2355	-773.8426	-464.5285	-210.8103	-126.3945	(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												47564.2113	(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												3441.2480	(219)

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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)	775.8638 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-12040.5403 (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	39826.7828 (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	47564.2113	0.2100	9988.4844 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3441.2480	0.2100	722.6621 (264)
Space and water heating			10711.1465 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	775.8638	0.1443	111.9811 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	0.1358	-496.2952
PV Unit electricity exported	-8386.6894	0.1264	-1059.8798
Total			-1556.1750 (269)
Total CO2, kg/year			9278.8818 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.6600 (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	47564.2113	1.1300	53747.5588 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3441.2480	1.1300	3888.6103 (278)
Space and water heating			57636.1691 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	775.8638	1.5338	1190.0458 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	1.5021	-5488.3259
PV Unit electricity exported	-8386.6894	0.4639	-3890.6533
Total			-9378.9791 (283)
Total Primary energy kWh/year			49577.3365 (286)
Target Primary Energy Rate (TPER)			56.9300 (287)

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Property Reference	12434			Issued on Date	30/09/2024
Assessment Reference	Be Lean RETAINED 0.30	Prop Type Ref	Detached House		
Property	41, Sheldon Avenue, London, N6 4JP				
SAP Rating	84 B	DER	9.88	TER	10.04
Environmental	88 B	% DER < TER			1.59
CO ₂ Emissions (t/year)	7.78	DFEE	49.37	TFEE	51.40
Compliance Check	See BREL	% DFEE < TFEE			3.95
% DPER < TPER	-9.31	DPER	58.60	TPER	53.61
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	243.6000 (1a)	x	2.9000 (2a)	=	706.4400 (1a)	- (3a)
Ground floor	298.1000 (1b)	x	3.8500 (2b)	=	1147.6850 (1b)	- (3b)
First floor	222.8000 (1c)	x	3.2200 (2c)	=	717.4160 (1c)	- (3c)
Second floor	106.3000 (1d)	x	2.6900 (2d)	=	285.9470 (1d)	- (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	2857.4880	(5)

2. Ventilation rate

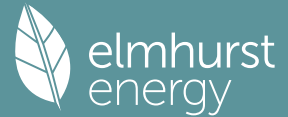
											m3 per hour			
Number of open chimneys	0 * 80 =											0.0000	(6a)	
Number of open flues	0 * 20 =											0.0000	(6b)	
Number of chimneys / flues attached to closed fire	0 * 10 =											0.0000	(6c)	
Number of flues attached to solid fuel boiler	0 * 20 =											0.0000	(6d)	
Number of flues 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												3.0000	(17)	
Infiltration rate												0.1500	(18)	
Number of sides sheltered												0	(19)	
Shelter factor	(20) = 1 - [0.075 x (19)] =											1.0000	(20)	
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =											0.1500	(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		
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750		
Adj infilt rate	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762		
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) =												74.7000	(23c)	
Effective ac	0.3177	0.3140	0.3103	0.2915	0.2877	0.2690	0.2690	0.2652	0.2765	0.2877	0.2953	0.3027		

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
Door			7.8500	1.0000	7.8500		(26)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1100	26.5661	110.0000	26566.1000 (28)
Ground floor			102.9200	0.1100	11.3212	110.0000	11321.2000 (28a)
Exposed floor to garage			10.8400	0.1524	1.6518	20.0000	216.8000 (28b)
Basement Wall	189.0000		189.0000	0.1300	24.5700	9.0000	1701.0000 (29a)
External Wall	432.5000	76.9700	355.5300	0.1300	46.2189	150.0000	53329.5000 (29a)
Stud Wall	231.0000		231.0000	0.0800	18.4800	18.0000	4158.0000 (29a)

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0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =												
Heat gains from water heating, kWh/month												
145.6043	129.1768	137.9854	122.7986	120.1110	109.3711	108.6310	112.2113	112.6589	124.2858	130.5645	144.1810	(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	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698 (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)												
	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588 (71)
Water heating gains (Table 5)												
	195.7047	192.2273	185.4643	170.5536	161.4395	151.9044	146.0095	150.8216	156.4707	167.0507	181.3396	193.7916 (72)
Total internal gains												
	1579.6528	1634.4350	1556.2082	1510.1162	1426.7504	1374.3467	1316.0914	1312.2165	1355.1794	1399.9409	1488.4813	1540.8019 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast						5.8300	11.2829	0.4000	0.0000	0.7700		20.2601 (75)
East						1.8000	19.6403	0.4000	0.0000	0.7700		10.8886 (76)
Southeast						24.3800	36.7938	0.4000	0.0000	0.7700		276.2864 (77)
South						1.8000	46.7521	0.4000	0.0000	0.7700		25.9193 (78)
Southwest						14.1600	36.7938	0.4000	0.0000	0.7700		160.4682 (79)
Northwest						53.5100	11.2829	0.4000	0.0000	0.7700		185.9551 (81)
Horizontal						7.7000	26.0000	0.4000	0.0000	1.0000		80.0800 (82)
Solar gains	759.8576	1393.7811	2159.0110	3077.5254	3799.9437	3923.8196	3720.2779	3160.7323	2475.1907	1609.5447	928.5434	638.2075 (83)
Total gains	2339.5104	3028.2161	3715.2192	4587.6416	5226.6941	5298.1663	5036.3693	4472.9488	3830.3701	3009.4855	2417.0247	2179.0094 (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	49.4066	49.6430	49.8817	51.1104	51.3634	52.6671	52.6671	52.9358	52.1377	51.3634	50.8598	50.3660
alpha	4.2938	4.3095	4.3254	4.4074	4.4242	4.5111	4.5111	4.5291	4.4758	4.4242	4.3907	4.3577
util living area	0.9994	0.9980	0.9932	0.9708	0.8986	0.7417	0.5815	0.6606	0.8995	0.9890	0.9985	0.9996 (86)
MIT	19.0490	19.2770	19.6445	20.1727	20.6191	20.8959	20.9731	20.9540	20.7231	20.1287	19.5135	19.0405 (87)
Th 2	20.2079	20.2113	20.2148	20.2323	20.2358	20.2534	20.2534	20.2569	20.2463	20.2358	20.2288	20.2218 (88)
util rest of house	0.9992	0.9975	0.9916	0.9634	0.8725	0.6811	0.4935	0.5728	0.8633	0.9854	0.9981	0.9995 (89)
MIT 2	17.8506	18.1453	18.6180	19.3005	19.8499	20.1702	20.2384	20.2288	19.9897	19.2521	18.4605	17.8491 (90)
Living area fraction									FLA = Living area / (4) =			0.0461 (91)
MIT	17.9059	18.1975	18.6654	19.3408	19.8854	20.2036	20.2723	20.2623	20.0236	19.2925	18.5091	17.9040 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7559	18.0475	18.5154	19.1908	19.7354	20.0536	20.1223	20.1123	19.8736	19.1425	18.3591	17.7540 (93)

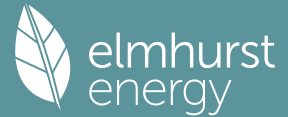
8. Space heating requirement

Utilisation	0.9985	0.9955	0.9862	0.9497	0.8517	0.6632	0.4772	0.5543	0.8406	0.9773	0.9966	Dec 0.9989 (94)
Useful gains	2335.9937	3014.4794	3663.9777	4357.0799	4451.3775	3513.6310	2403.5917	2479.1546	3219.7859	2941.1350	2408.7187	2176.6621 (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	9991.9092	9716.3952	8837.2665	7386.8704	5739.4955	3798.9997	2453.6217	2572.8492	4062.6755	6101.7395	8121.7594	9873.0622 (97)
Space heating kWh	5696.0011	4503.6874	3848.9269	2181.4492	958.3598	0.0000	0.0000	0.0000	0.0000	2351.4897	4113.3894	5726.1217 (98a)
Space heating requirement - total per year (kWh/year)												29379.4253
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	5696.0011	4503.6874	3848.9269	2181.4492	958.3598	0.0000	0.0000	0.0000	0.0000	2351.4897	4113.3894	5726.1217 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												29379.4253
Space heating per m2										(98c) / (4) =		33.7384 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	6548.0212	5154.8252	5267.2701	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7667	0.8457	0.7879	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5020.6071	4359.2767	4149.8228	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5813.2686	5524.0498	4894.5858	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	570.7163	866.5912	554.1037	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =			0.1837 (105)
Intermittency factor (Table 10b)												

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Space cooling kWh	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	26.2157	39.8067	25.4526	0.0000	0.0000	0.0000 (107)
											91.4750 (107)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												89.5000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												5.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	5696.0011	4503.6874	3848.9269	2181.4492	958.3598	0.0000	0.0000	0.0000	0.0000	2351.4897	4113.3894	5726.1217 (98)
Space heating efficiency (main heating system 1)	89.5000	89.5000	89.5000	89.5000	89.5000	0.0000	0.0000	0.0000	0.0000	89.5000	89.5000	89.5000 (210)
Space heating fuel (main heating system)	6364.2471	5032.0530	4300.4770	2437.3734	1070.7931	0.0000	0.0000	0.0000	0.0000	2627.3628	4595.9658	6397.9013 (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	360.7160	318.7801	337.8021	294.6176	284.0445	254.2342	249.5182	260.2859	264.1223	296.6001	317.9736	356.4353 (64)
Efficiency of water heater (217)m	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000	89.5000 (216)
Fuel for water heating, kWh/month	403.0346	356.1789	377.4325	329.1816	317.3681	284.0605	278.7913	290.8223	295.1087	331.3968	355.2777	398.2518 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	5.2431	7.9613	5.0905	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	438.7238	396.2667	438.7238	424.5714	438.7238	424.5714	438.7238	438.7238	424.5714	438.7238	424.5714	438.7238 (231)
Lighting	125.7565	100.8865	90.8371	66.5512	51.4060	41.9992	46.8943	60.9550	79.1745	103.8812	117.3336	129.2516 (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												32826.1735 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												89.5000
Water heating fuel used												4016.9048 (219)
Space cooling fuel												18.2950 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4700)												
mechanical ventilation fans (SFP = 1.4700)												5124.6190 (230a)
central heating pump												41.0000 (230c)
Total electricity for the above, kWh/year												5165.6190 (231)
Electricity for lighting (calculated in Appendix L)												1014.9267 (232)
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												43041.9189 (238)

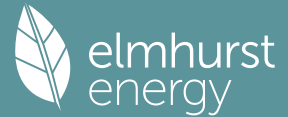
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	32826.1735	0.2100	6893.4964 (261)
Total CO2 associated with community systems			0.0000 (273)
Water heating (other fuel)	4016.9048	0.2100	843.5500 (264)
Space and water heating			7737.0464 (265)
Space cooling	18.2950	0.1139	2.0830 (266)
Pumps, fans and electric keep-hot	5165.6190	0.1387	716.5350 (267)
Energy for lighting	1014.9267	0.1443	146.4853 (268)
Total CO2, kg/year			8602.1498 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			9.8800 (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	32826.1735	1.1300	37093.5760 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	4016.9048	1.1300	4539.1024 (278)
Space and water heating			41632.6785 (279)
Space cooling	18.2950	1.4197	25.9738 (280)

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Pumps, fans and electric keep-hot	5165.6190	1.5128	7814.5484 (281)
Energy for lighting	1014.9267	1.5338	1556.7284 (282)
Total Primary energy kWh/year			51029.9290 (286)
Dwelling Primary energy Rate (DPER)			58.6000 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	243.6000 (1a)	x 2.9000 (2a)	= 706.4400 (1a) - (3a)
Ground floor	298.1000 (1b)	x 3.8500 (2b)	= 1147.6850 (1b) - (3b)
First floor	222.8000 (1c)	x 3.2200 (2c)	= 717.4160 (1c) - (3c)
Second floor	106.3000 (1d)	x 2.6900 (2d)	= 285.9470 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2857.4880 (5)

2. Ventilation rate

	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0140 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2640 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2640 (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	0.3366	0.3300	0.3234	0.2904	0.2838	0.2508	0.2508	0.2442	0.2640	0.2838	0.2970	0.3102 (22b)
Effective ac	0.5566	0.5544	0.5523	0.5422	0.5403	0.5314	0.5314	0.5298	0.5348	0.5403	0.5441	0.5481 (25)

3. Heat losses and heat loss parameter

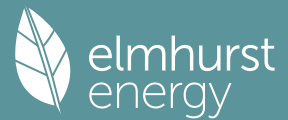
Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			7.8500	1.0000	7.8500		(26)
TER Opening Type (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1300	31.3963		(28)
Ground floor			102.9200	0.1300	13.3796		(28a)
Exposed floor to garage			10.8400	0.1300	1.4092		(28b)
Basement Wall	189.0000		189.0000	0.1800	34.0200		(29a)
External Wall	432.5000	76.9700	355.5300	0.1800	63.9954		(29a)
Stud Wall	231.0000		231.0000	0.1800	41.5800		(29a)
Dormer Walls	7.2000	6.2800	0.9200	0.1800	0.1656		(29a)
Wall to garage	38.5400		38.5400	0.1800	6.9372		(29a)
Retained Front Facade	97.5000	26.0800	71.4200	0.1800	12.8556		(29a)
Pitch Roof	182.0000		182.0000	0.1100	20.0200		(30)
Flat Roof	103.2800	4.2800	99.0000	0.1100	10.8900		(30)
Flat Blue Roof	29.3200		29.3200	0.1100	3.2252		(30)
Dormer Roof	8.8500		8.8500	0.1100	0.9735		(30)
Ceiling to loft void	125.9100		125.9100	0.1100	13.8501		(30)
Basement ceiling to garage	23.6400		23.6400	0.1100	2.6004		(30)
Basement ceiling garden rear	23.1700	3.4200	19.7500	0.1100	2.1725		(30)
Total net area of external elements Aum(A, m ²)			1847.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	395.7756		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 151.6720 (35)

List of Thermal Bridges

K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	59.0500	0.0500	2.9525
E3 Sill	55.8000	0.0500	2.7900
E4 Jamb	199.5000	0.0500	9.9750
E5 Ground floor (normal)	50.8400	0.1600	8.1344
E19 Ground floor (inverted)	14.1300	0.0700	0.9891
E20 Exposed floor (normal)	6.6100	0.3200	2.1152
E21 Exposed floor (inverted)	6.6100	0.3200	2.1152
E22 Basement floor	65.2000	0.0700	4.5640

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E6 Intermediate floor within a dwelling	206.0500	0.0000	0.0000										
E8 Balcony within a dwelling, wall insulation continuous	8.9500	0.0000	0.0000										
E11 Eaves (insulation at rafter level)	50.4300	0.0400	2.0172										
E14 Flat roof	96.8000	0.0800	7.7440										
E16 Corner (normal)	71.6900	0.0900	6.4521										
E17 Corner (inverted - internal area greater than external area)	43.0500	-0.0900	-3.8745										
R1 Head of roof window	5.5000	0.0800	0.4400										
R2 Sill of roof window	5.5000	0.0600	0.3300										
R3 Jamb of roof window	11.6000	0.0800	0.9280										
R4 Ridge (vaulted ceiling)	2.9700	0.0800	0.2376										
R5 Ridge (inverted)	13.0000	0.0400	0.5200										
R6 Flat ceiling	35.7500	0.0600	2.1450										
R7 Flat ceiling (inverted)	6.6000	0.0400	0.2640										
R9 Roof to wall (flat ceiling)	6.6000	0.0400	0.2640										
E16 Corner (normal)	28.2800	0.0900	2.5452										
E17 Corner (inverted - internal area greater than external area)	29.5400	-0.0900	-2.6586										
E5 Ground floor (normal)	14.3600	0.1600	2.2976										
E6 Intermediate floor within a dwelling	13.1100	0.0000	0.0000										
Thermal bridges (Sum(L x Psi) calculated using Appendix K)												53.2870	(36)
Point Thermal bridges												0.0000	
Total fabric heat loss												(33) + (36) + (36a) =	449.0626 (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	524.9039	522.8296	520.7964	511.2464	509.4596	501.1419	501.1419	499.6016	504.3458	509.4596	513.0743	516.8532	(38)
Average = Sum(39)m / 12 =	973.9666	971.8923	969.8590	960.3090	958.5223	950.2045	950.2045	948.6642	953.4084	958.5223	962.1369	965.9158	(39)
												960.3005	
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.1185	1.1161	1.1138	1.1028	1.1007	1.0912	1.0912	1.0894	1.0949	1.1007	1.1049	1.1092	(40)
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	
												1.1028	
												31	

4. Water heating energy requirements (kWh/year)													

Assumed occupancy													3.8740 (42)
Hot water usage for mixer showers			85.8809	82.1446	79.3873	76.3123	74.5646	76.5026	78.6270	81.9286	85.7451	88.8322	(42a)
Hot water usage for baths	89.1739	87.8337											
Hot water usage for other uses	38.4709	37.8995	37.0950	35.6115	34.5007	33.2689	32.6036	33.4026	34.2725	35.5905	37.1045	38.3408	(42b)
Average daily hot water use (litres/day)	54.3033	52.3287	50.3540	48.3793	46.4047	44.4300	44.4300	46.4047	48.3793	50.3540	52.3287	54.3033	(42c)
												167.2505	(43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	181.9481	178.0619	173.3299	166.1354	160.2926	154.0113	151.5982	156.3098	161.2788	167.8730	175.1783	181.4764	(44)
Energy content (annual)	288.1613	253.5578	266.4016	227.4311	215.7846	189.3748	183.3448	193.5442	198.8729	227.8021	249.5736	284.1481	(45)
Distribution loss (46)m = 0.15 x (45)m	43.2242	38.0337	39.9602	34.1147	32.3677	28.4062	27.5017	29.0316	29.8309	34.1703	37.4360	42.6222	(46)
Water storage loss:													
Store volume													150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.3938 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.7527 (55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(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	334.7562	295.6436	312.9965	272.5229	262.3795	234.4667	229.9397	240.1391	243.9647	274.3970	294.6655	330.7430	(62)
WWHRS	-40.7666	-36.0543	-37.7540	-31.2618	-29.1349	-24.9309	-23.3687	-24.8503	-25.7945	-30.4088	-34.4495	-40.0116	(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	293.9896	259.5893	275.2425	241.2611	233.2447	209.5358	206.5710	215.2888	218.1703	243.9881	260.2159	290.7314	(64)
12Total per year (kWh/year)												2947.8285	(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	133.0895	117.9766	125.8545	111.6943	109.0243	99.0406	98.2381	101.6294	102.1987	113.0201	119.0567	131.7552	(65)

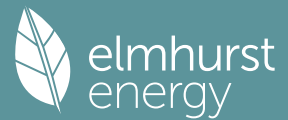
5. Internal gains (see Table 5 and 5a)													

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	(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)	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	(71)
Water heating gains (Table 5)	178.8838	175.5604	169.1592	155.1310	146.5381	137.5564	132.0404	136.5986	141.9426	151.9088	165.3565	177.0903	(72)
Total internal gains	1562.8319	1617.7680	1539.9032	1494.6935	1411.8490	1359.9987	1302.1224	1297.9935	1340.6513	1384.7989	1472.4983	1524.1006	(73)

6. Solar gains													

[Jan]	Area	Solar flux	g	FF	Access	Gains							

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	m2	Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	factor Table 6d	W
Northeast	5.8300	11.2829	0.6300	0.7000	0.7700	20.1031 (75)
East	1.8000	19.6403	0.6300	0.7000	0.7700	10.8042 (76)
Southeast	24.3800	36.7938	0.6300	0.7000	0.7700	274.1451 (77)
South	1.8000	46.7521	0.6300	0.7000	0.7700	25.7185 (78)
Southwest	14.1600	36.7938	0.6300	0.7000	0.7700	159.2246 (79)
Northwest	53.5100	11.2829	0.6300	0.7000	0.7700	184.5139 (81)
Horizontal	7.7000	26.0000	0.6300	0.7000	1.0000	79.4594 (82)

Solar gains	753.9687	1382.9793	2142.2787	3053.6745	3770.4941	3893.4100	3691.4457	3136.2367	2456.0080	1597.0707	921.3472	633.2614 (83)
Total gains	2316.8007	3000.7473	3682.1819	4548.3681	5182.3431	5253.4087	4993.5681	4434.2301	3796.6593	2981.8695	2393.8454	2157.3620 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	37.6684	37.7488	37.8280	38.2041	38.2754	38.6104	38.6104	38.6731	38.4807	38.2754	38.1316	37.9824
alpha	3.5112	3.5166	3.5219	3.5469	3.5517	3.5740	3.5740	3.5782	3.5654	3.5517	3.5421	3.5322
util living area	0.9991	0.9976	0.9934	0.9778	0.9334	0.8346	0.7074	0.7753	0.9352	0.9903	0.9981	0.9993 (86)
MIT	18.4868	18.7189	19.1232	19.7025	20.2620	20.6921	20.8823	20.8319	20.4510	19.7301	19.0140	18.4588 (87)
Th 2	19.9858	19.9877	19.9896	19.9986	20.0002	20.0080	20.0080	20.0095	20.0050	20.0002	19.9968	19.9933 (88)
util rest of house	0.9989	0.9970	0.9917	0.9714	0.9113	0.7727	0.5923	0.6717	0.9042	0.9867	0.9976	0.9991 (89)
MIT 2	16.9891	17.2879	17.8067	18.5501	19.2493	19.7566	19.9426	19.9056	19.4940	18.5909	17.6721	16.9577 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.0582	17.3539	17.8674	18.6033	19.2960	19.7998	19.9860	19.9483	19.5381	18.6434	17.7340	17.0269 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.0582	17.3539	17.8674	18.6033	19.2960	19.7998	19.9860	19.9483	19.5381	18.6434	17.7340	17.0269 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9978	0.9944	0.9859	0.9582	0.8906	0.7568	0.5893	0.6640	0.8839	0.9787	0.9955	0.9983 (94)
Useful gains	2311.6216	2983.9855	3630.2651	4358.1614	4615.1751	3975.8271	2942.7820	2944.2339	3355.6834	2918.3882	2383.1439	2153.6501 (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	12426.0652	12103.8181	11024.7626	9318.1509	7280.9555	4940.8738	3217.3819	3366.1900	5184.7466	7709.7845	10231.3245	12389.7171 (97)
Space heating kWh	7525.1460	6128.5275	5501.5062	3571.1924	1983.3406	0.0000	0.0000	0.0000	0.0000	3564.7988	5650.6901	7615.6339 (98a)
Space heating requirement - total per year (kWh/year)												41540.8354
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	7525.1460	6128.5275	5501.5062	3571.1924	1983.3406	0.0000	0.0000	0.0000	0.0000	3564.7988	5650.6901	7615.6339 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												41540.8354
Space heating per m2												(98c) / (4) = 47.7042 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	7525.1460	6128.5275	5501.5062	3571.1924	1983.3406	0.0000	0.0000	0.0000	0.0000	3564.7988	5650.6901	7615.6339 (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)	8152.9209	6639.7914	5960.4617	3869.1142	2148.7980	0.0000	0.0000	0.0000	0.0000	3862.1872	6122.0911	8250.9576 (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	293.9896	259.5893	275.2425	241.2611	233.2447	209.5358	206.5710	215.2888	218.1703	243.9881	260.2159	290.7314 (64)
Efficiency of water heater	88.4250	88.3949	88.3254	88.1707	87.7585	79.8000	79.8000	79.8000	79.8000	88.1630	88.3613	79.8000 (216)
Fuel for water heating, kWh/month	332.4733	293.6700	311.6234	273.6296	265.7802	262.5761	258.8609	269.7854	273.3963	276.7465	294.4909	328.7580 (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	96.1349	77.1230	69.4407	50.8752	39.2975	32.1064	35.8485	46.5972	60.5252	79.4123	89.6960	98.8068 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-197.6255	-264.4063	-360.4289	-382.9514	-394.1361	-360.2710	-354.7627	-343.2823	-321.5254	-290.3090	-211.6789	-172.4735 (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	-159.0528	-327.7963	-639.8878	-945.1630	-1235.3883	-1237.0952	-1223.4945	-1043.2355	-773.8426	-464.5285	-210.8103	-126.3945 (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)												

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(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												45006.3222	(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												3441.7906	(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)												775.8638	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-12040.5403	(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												37269.4362	(238)

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

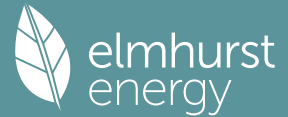
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	45006.3222	0.2100	9451.3277 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3441.7906	0.2100	722.7760 (264)
Space and water heating			10174.1037 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	775.8638	0.1443	111.9811 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	0.1358	-496.2952
PV Unit electricity exported	-8386.6894	0.1264	-1059.8798
Total			-1556.1750 (269)
Total CO2, kg/year			8741.8390 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0400 (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	45006.3222	1.1300	50857.1441 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3441.7906	1.1300	3889.2233 (278)
Space and water heating			54746.3674 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	775.8638	1.5338	1190.0458 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	1.5021	-5488.3259
PV Unit electricity exported	-8386.6894	0.4639	-3890.6533
Total			-9378.9791 (283)
Total Primary energy kWh/year			46687.5349 (286)
Target Primary Energy Rate (TPER)			53.6100 (287)

12 Appendix 2 - Be Green DER/TER SAP Worksheets

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Property Reference	12434				Issued on Date	30/09/2024		
Assessment Reference	Be Green New Build			Prop Type Ref	Detached House			
Property	41, Sheldon Avenue, London, N6 4JP							
SAP Rating	86 B		DER	2.17		TER	10.75	
Environmental	97 A		% DER < TER				79.81	
CO ₂ Emissions (t/year)	1.68		DFEE	50.12		TFEE	53.79	
Compliance Check	See BREL		% DFEE < TFEE				6.82	
% DPER < TPER	57.89		DPER	24.20		TPER	57.47	
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	243.0000 (1a)	x 2.9000 (2a)	= 704.7000 (1a) - (3a)
Ground floor	299.0000 (1b)	x 3.8500 (2b)	= 1151.1500 (1b) - (3b)
First floor	221.0000 (1c)	x 3.2200 (2c)	= 711.6200 (1c) - (3c)
Second floor	95.9200 (1d)	x 2.6900 (2d)	= 258.0248 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	858.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2825.4948 (5)

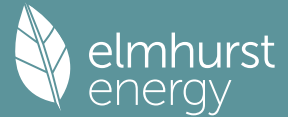
2. Ventilation rate

											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											3.0000 (17)	
Infiltration rate											0.1500 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1500 (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												
	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (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) =											74.7000 (23c)	
Effective ac	0.3177	0.3140	0.3103	0.2915	0.2877	0.2690	0.2690	0.2652	0.2765	0.2877	0.2953	0.3027 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
Door			7.8500	1.0000	7.8500		(26)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1100	26.5661	110.0000	26566.1000 (28)
Ground floor			102.9200	0.1100	11.3212	110.0000	11321.2000 (28a)
Exposed floor to garage			10.8400	0.1524	1.6518	20.0000	216.8000 (28b)
Basement Wall	189.0000		189.0000	0.1300	24.5700	9.0000	1701.0000 (29a)
External Wall	530.0000	103.0500	426.9500	0.1300	55.5035	150.0000	64042.5000 (29a)
Stud Wall	231.0000		231.0000	0.0800	18.4800	18.0000	4158.0000 (29a)

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Heat gains from water heating, kWh/month
153.8401 136.5193 145.8608 129.8176 126.9970 115.6576 114.8587 118.6170 119.0652 131.3381 137.9632 152.3323 (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	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	457.4294	506.4397	457.4294	472.6771	457.4294	472.6771	457.4294	457.4294	472.6771	457.4294	472.6771	457.4294	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	830.1945	838.8093	817.1002	770.8842	712.5447	657.7139	621.0835	612.4687	634.1778	680.3938	738.7332	793.5641	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	(71)
Water heating gains (Table 5)	206.7744	203.1537	196.0494	180.3022	170.6949	160.6356	154.3800	159.4314	165.3683	176.5297	191.6156	204.7477	(72)
Total internal gains	1575.2762	1629.2807	1551.4570	1504.7414	1421.5470	1371.9045	1313.7708	1310.2074	1353.1010	1395.2308	1483.9038	1536.6191	(73)

6. Solar gains

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

Northeast					5.8300	11.2829		0.4000	0.0000	0.7700			20.2601 (75)	
East					1.8000	19.6403		0.4000	0.0000	0.7700			10.8886 (76)	
Southeast					24.3800	36.7938		0.4000	0.0000	0.7700			276.2864 (77)	
South					1.8000	46.7521		0.4000	0.0000	0.7700			25.9193 (78)	
Southwest					14.1600	36.7938		0.4000	0.0000	0.7700			160.4682 (79)	
Northwest					53.5100	11.2829		0.4000	0.0000	0.7700			185.9551 (81)	
Horizontal					7.7000	26.0000		0.4000	0.0000	1.0000			80.0800 (82)	

Solar gains	759.8576	1393.7811	2159.0110	3077.5254	3799.9437	3923.8196	3720.2779	3160.7323	2475.1907	1609.5447	928.5434	638.2075 (83)		
Total gains	2335.1338	3023.0617	3710.4680	4582.2668	5221.4907	5295.7240	5034.0486	4470.9398	3828.2917	3004.7755	2412.4472	2174.8266 (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	72.4560	72.8116	73.1706	75.0203	75.4015	77.3672	77.3672	77.7727	76.5688	75.4015	74.6429	73.8994	
alpha	5.8304	5.8541	5.8780	6.0014	6.0268	6.1578	6.1578	6.1848	6.1046	6.0268	5.9762	5.9266	
util living area	0.9999	0.9997	0.9984	0.9876	0.9290	0.7563	0.5769	0.6639	0.9295	0.9969	0.9998	1.0000	(86)
Living	19.8738	20.0039	20.2126	20.5171	20.7746	20.9172	20.9443	20.9384	20.8234	20.4813	20.1354	19.8712	
Non living	18.8585	19.0284	19.2987	19.7011	20.0181	20.1831	20.2031	20.2037	20.0887	19.6602	19.2113	18.8666	
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	20.4239	20.0039	20.2126	20.5171	20.7746	20.9172	20.9443	20.9384	20.8234	20.4813	20.1354	20.0291	(87)
Th 2	20.2242	20.2277	20.2313	20.2488	20.2524	20.2700	20.2700	20.2736	20.2630	20.2524	20.2453	20.2383	(88)
util rest of house	0.9999	0.9996	0.9979	0.9831	0.9036	0.6890	0.4858	0.5696	0.8937	0.9954	0.9997	1.0000	(89)
MIT 2	19.6798	19.0284	19.2987	19.7011	20.0181	20.1831	20.2031	20.2037	20.0887	19.6602	19.2113	19.1137	(90)
Living area fraction									fLA = Living area / (4) =			0.0468	(91)
MIT	19.7146	19.0740	19.3414	19.7392	20.0535	20.2174	20.2378	20.2381	20.1230	19.6986	19.2545	19.1565	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7146	19.0740	19.3414	19.7392	20.0535	20.2174	20.2378	20.2381	20.1230	19.6986	19.2545	19.1565	(93)

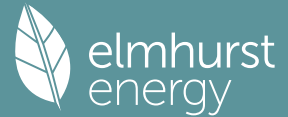
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9999	0.9994	0.9970	0.9791	0.8954	0.6837	0.4817	0.5648	0.8852	0.9937	0.9996	0.9999	(94)
Useful gains	2334.9190	3021.2451	3699.2136	4486.3496	4675.3981	3620.8071	2424.9192	2524.9806	3388.7542	2985.9403	2411.4844	2174.6739	(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	11037.8775	10099.9844	9105.5066	7496.3291	5747.9978	3767.0995	2439.5263	2560.4458	4081.2328	6260.7018	8448.4635	10500.7111	(97)
Space heating kWh	6475.0011	4756.9128	4022.2820	2167.1852	798.0142	0.0000	0.0000	0.0000	0.0000	2436.4225	4346.6250	6194.5717	(98a)
Space heating requirement - total per year (kWh/year)												31197.0145	
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	6475.0011	4756.9128	4022.2820	2167.1852	798.0142	0.0000	0.0000	0.0000	0.0000	2436.4225	4346.6250	6194.5717	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												31197.0145	
Space heating per m2										(98c) / (4) =		36.3212	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8231	0.9019	0.8452	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5188.7076	4475.7574	4285.0991	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5812.7353	5523.5657	4894.2520	0.0000	0.0000	0.0000	0.0000	(102)
Space cooling kWh													(103)

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Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	449.2999	779.5694	453.2097	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1863 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	20.9239	36.3046	21.1060	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling requirement												78.3346 (107)

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 %)												369.7747 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												5.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	6475.0011	4756.9128	4022.2820	2167.1852	798.0142	0.0000	0.0000	0.0000	0.0000	2436.4225	4346.6250	6194.5717 (98)
Space heating efficiency (main heating system 1)	369.7747	369.7747	369.7747	369.7747	369.7747	0.0000	0.0000	0.0000	0.0000	369.7747	369.7747	369.7747 (210)
Space heating fuel (main heating system)	1751.0668	1286.4356	1087.7657	586.0827	215.8110	0.0000	0.0000	0.0000	0.0000	658.8939	1175.4794	1675.2288 (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	380.7782	336.6111	356.7800	311.1718	300.0470	268.5854	263.5407	274.8438	278.8336	313.1028	335.6700	376.2433 (64)
Efficiency of water heater (217)m	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420	183.7420 (216)
Fuel for water heating, kWh/month	207.2352	183.1977	194.1744	169.3526	163.2979	146.1753	143.4297	149.5813	151.7528	170.4035	182.6854	204.7671 (219)
Space cooling fuel requirement (221)m	0.0000	0.0000	0.0000	0.0000	0.0000	4.1848	7.2609	4.2212	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	430.3685	388.7200	430.3685	416.4857	430.3685	416.4857	430.3685	430.3685	416.4857	430.3685	416.4857	430.3685 (231)
Lighting	124.2144	99.6494	89.7232	65.7351	50.7757	41.4842	46.3193	60.2075	78.2036	102.6074	115.8948	127.6667 (232)
Electricity generated by PVs (Appendix M) (negative quantity) (233a)m	-95.3762	-153.4285	-252.1527	-312.2939	-348.5167	-321.1357	-317.3271	-286.6133	-234.4592	-184.6089	-109.8099	-79.7834 (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	-18.7904	-46.7354	-111.7197	-204.3238	-311.6447	-336.1000	-327.8197	-263.0478	-175.6638	-77.7767	-27.5759	-14.3915 (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												8436.7639 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												183.7420
Water heating fuel used												2066.0528 (219)
Space cooling fuel												15.6669 (221)

Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4700)												
mechanical ventilation fans (SFP = 1.4700)												5067.2424 (230a)
Total electricity for the above, kWh/year												5067.2424 (231)
Electricity for lighting (calculated in Appendix L)												1002.4814 (232)

Energy saving/generation technologies (Appendices M, N and Q)												
PV generation												-4611.0948 (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												11977.1125 (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	8436.7639	0.1553	1310.1479 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2066.0528	0.1411	291.4385 (264)
Space and water heating			1601.5863 (265)
Space cooling	15.6669	0.1137	1.7809 (266)
Pumps, fans and electric keep-hot	5067.2424	0.1387	702.8890 (267)
Energy for lighting	1002.4814	0.1443	144.6890 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2695.5053	0.1330	-358.4936
PV Unit electricity exported	-1915.5895	0.1208	-231.3784
Total			-589.8720 (269)
Total CO2, kg/year			1861.0733 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.1700 (273)

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

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	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year	
Space heating - main system 1	8436.7639	1.5749	13287.1753	(275)
Total CO ₂ associated with community systems			0.0000	(473)
Water heating (other fuel)	2066.0528	1.5216	3143.7033	(278)
Space and water heating			16430.8786	(279)
Space cooling	15.6669	1.4191	22.2328	(280)
Pumps, fans and electric keep-hot	5067.2424	1.5128	7665.7243	(281)
Energy for lighting	1002.4814	1.5338	1537.6394	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2695.5053	1.4915	-4020.2453	
PV Unit electricity exported	-1915.5895	0.4431	-848.7504	
Total			-4868.9957	(283)
Total Primary energy kWh/year			20787.4793	(286)
Dwelling Primary energy Rate (DPER)			24.2000	(287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)	
Basement floor	243.0000 (1a)	x 2.9000 (2a)	= 704.7000 (1a) - (3a)	
Ground floor	299.0000 (1b)	x 3.8500 (2b)	= 1151.1500 (1b) - (3b)	
First floor	221.0000 (1c)	x 3.2200 (2c)	= 711.6200 (1c) - (3c)	
Second floor	95.9200 (1d)	x 2.6900 (2d)	= 258.0248 (1d) - (3d)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	858.9200			
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2825.4948 (5)	

2. Ventilation rate

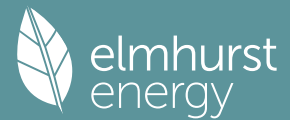
	m ³ per hour	
Number of open chimneys	0 * 80 =	0.0000 (6a)
Number of open flues	0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000 (6d)
Number of flues attached to other heater	0 * 35 =	0.0000 (6e)
Number of blocked chimneys	0 * 20 =	0.0000 (6f)
Number of intermittent extract fans	4 * 10 =	40.0000 (7a)
Number of passive vents	0 * 10 =	0.0000 (7b)
Number of flueless gas fires	0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0142 (8)
Pressure test	Yes	
Pressure Test Method	Blower Door	
Measured/design AP50	5.0000	(17)
Infiltration rate	0.2642	(18)
Number of sides sheltered	0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2642 (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	0.3368	0.3302	0.3236	0.2906	0.2840	0.2509	0.2509	0.2443	0.2642	0.2840	0.2972	0.3104	(22b)
Effective ac	0.5567	0.5545	0.5524	0.5422	0.5403	0.5315	0.5315	0.5299	0.5349	0.5403	0.5442	0.5482	(25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K	
TER Opaque door			7.8500	1.0000	7.8500			(26)
TER Opening Type (Uw = 1.20)			101.4800	1.1450	116.1985			(27)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438			(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897			(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247			(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983			(27a)
Basement floor			241.5100	0.1300	31.3963			(28)
Ground floor			102.9200	0.1300	13.3796			(28a)
Exposed floor to garage			10.8400	0.1300	1.4092			(28b)
Basement Wall	189.0000		189.0000	0.1800	34.0200			(29a)
External Wall	530.0000	103.0500	426.9500	0.1800	76.8510			(29a)
Stud Wall	231.0000		231.0000	0.1800	41.5800			(29a)
Dormer Walls	7.2000	6.2800	0.9200	0.1800	0.1656			(29a)
Wall to garage	38.5400		38.5400	0.1800	6.9372			(29a)
Pitch Roof	182.0000		182.0000	0.1100	20.0200			(30)
Flat Roof	103.2800	4.2800	99.0000	0.1100	10.8900			(30)
Flat Blue Roof	29.3200		29.3200	0.1100	3.2252			(30)
Dormer Roof	8.8500		8.8500	0.1100	0.9735			(30)
Ceiling to loft void	125.9100		125.9100	0.1100	13.8501			(30)
Basement ceiling to garage	23.6400		23.6400	0.1100	2.6004			(30)
Basement ceiling garden rear	23.1700	3.4200	19.7500	0.1100	2.1725			(30)
Total net area of external elements Aum(A, m ²)			1847.1800					(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	395.7756		(33)

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

217.4594 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element	59.0500	0.0500	2.9525
E2 Other lintels (including other steel lintels)	55.8000	0.0500	2.7900
E3 Sill	199.5000	0.0500	9.9750
E4 Jamb	65.2000	0.1600	10.4320
E5 Ground floor (normal)	14.1300	0.0700	0.9891
E19 Ground floor (inverted)	6.6100	0.3200	2.1152
E20 Exposed floor (normal)	6.6100	0.3200	2.1152
E21 Exposed floor (inverted)	65.2000	0.0700	4.5640
E22 Basement floor	219.1600	0.0000	0.0000
E6 Intermediate floor within a dwelling	8.9500	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	50.4300	0.0400	2.0172
E11 Eaves (insulation at rafter level)	96.8000	0.0800	7.7440
E14 Flat roof	99.9700	0.0900	8.9973
E16 Corner (normal)	72.5900	-0.0900	-6.5331
E17 Corner (inverted - internal area greater than external area)	5.5000	0.0800	0.4400
R1 Head of roof window	5.5000	0.0600	0.3300
R2 Sill of roof window	11.6000	0.0800	0.9280
R3 Jamb of roof window	2.9700	0.0800	0.2376
R4 Ridge (vaulted ceiling)	13.0000	0.0400	0.5200
R5 Ridge (inverted)	35.7500	0.0600	2.1450
R6 Flat ceiling	6.6000	0.0400	0.2640
R7 Flat ceiling (inverted)	6.6000	0.0400	0.2640
R9 Roof to wall (flat ceiling)			

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

53.2870 (36)

Point Thermal bridges

(36a) = 0.0000

Total fabric heat loss

(33) + (36) + (36a) = 449.0626 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	519.0904	517.0369	515.0240	505.5696	503.8007	495.5662	495.5662	494.0413	498.7380	503.8007	507.3791	511.1202 (38)
Heat transfer coeff	968.1530	966.0995	964.0866	954.6322	952.8633	944.6288	944.6288	943.1039	947.8006	952.8633	956.4418	960.1829 (39)
Average = Sum(39)m / 12 =												954.6237

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1272	1.1248	1.1224	1.1114	1.1094	1.0998	1.0998	1.0980	1.1035	1.1094	1.1135	1.1179 (40)
HLP (average)												1.1114
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy													3.8585 (42)
Hot water usage for mixer showers													
88.9149	87.5787	85.6316	81.9061	79.1568	76.0907	74.3480	76.2804	78.3987	81.6906	85.4962	88.5742	(42a)	
Hot water usage for baths													
38.3595	37.7898	36.9876	35.5084	34.4008	33.1726	32.5092	33.3059	34.1733	35.4874	36.9971	38.2299	(42b)	
Hot water usage for other uses													
54.1452	52.1762	50.2073	48.2384	46.2695	44.3006	44.3006	46.2695	48.2384	50.2073	52.1762	54.1452	(42c)	
Average daily hot water use (litres/day)													166.7648 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
181.4196	177.5448	172.8265	165.6529	159.8270	153.5640	151.1578	155.8558	160.8104	167.3854	174.6695	180.9493	(44)	
Energy conte	287.3243	252.8214	265.6279	226.7705	215.1579	188.8248	182.8123	192.9820	198.2953	227.1404	248.8487	283.3228	(45)
Energy content (annual)										Total = Sum(45)m =			2769.9284
Distribution loss (46)m = 0.15 x (45)m													
43.0986	37.9232	39.8442	34.0156	32.2737	28.3237	27.4218	28.9473	29.7443	34.0711	37.3273	42.4984	(46)	
Water storage loss:													
Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.1127 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.1409 (55)
Total storage loss													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)	
If cylinder contains dedicated solar storage													
35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(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	(61)	
Total heat required for water heating calculated for each month													
345.9531	305.7765	324.2567	283.5081	273.7867	245.5624	241.4411	251.6108	255.0328	285.7692	305.5863	341.9516	(62)	
WWHRS	-40.6482	-35.9496	-37.6443	-31.1710	-29.0502	-24.8585	-23.3009	-24.7782	-25.7196	-30.3205	-34.3495	-39.8954	(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													
305.3049	269.8269	286.6123	252.3371	244.7365	220.7039	218.1402	226.8327	229.3133	255.4487	271.2368	302.0562	(64)	
12Total per year (kWh/year)													3082.5495 (64)
Electric shower(s)													3083 (64)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(64a)	
Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =													0.0000 (64a)
Heat gains from water heating, kWh/month													
142.4384	126.4272	135.2243	120.7912	118.4431	108.1743	107.6881	111.0696	111.3232	122.4272	128.1322	141.1079	(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	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263	192.9263 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	457.4294	506.4397	457.4294	472.6771	457.4294	472.6771	457.4294	457.4294	472.6771	457.4294	472.6771	457.4294 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	830.1945	838.8093	817.1002	770.8842	712.5447	657.7139	621.0835	612.4687	634.1778	680.3938	738.7332	793.5641 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926	42.2926 (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)												
	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410	-154.3410 (71)
Water heating gains (Table 5)												
	191.4494	188.1357	181.7531	167.7656	159.1977	150.2421	144.7421	149.2871	154.6156	164.5527	177.9615	189.6611 (72)
Total internal gains												
	1562.9513	1617.2626	1540.1607	1495.2048	1413.0497	1361.5109	1304.1330	1300.0631	1342.3483	1386.2539	1473.2497	1524.5326 (73)

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6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
Northeast				5.8300	11.2829	0.6300	0.7000		0.7700	20.1031 (75)		
East				1.8000	19.6403	0.6300	0.7000		0.7700	10.8042 (76)		
Southeast				24.3800	36.7938	0.6300	0.7000		0.7700	274.1451 (77)		
South				1.8000	46.7521	0.6300	0.7000		0.7700	25.7185 (78)		
Southwest				14.1600	36.7938	0.6300	0.7000		0.7700	159.2246 (79)		
Northwest				53.5100	11.2829	0.6300	0.7000		0.7700	184.5139 (81)		
Horizontal				7.7000	26.0000	0.6300	0.7000		1.0000	79.4594 (82)		
Solar gains	753.9687	1382.9793	2142.2787	3053.6745	3770.4941	3893.4100	3691.4457	3136.2367	2456.0080	1597.0707	921.3472	633.2614 (83)
Total gains	2316.9200	3000.2419	3682.4393	4548.8793	5183.5438	5254.9209	4995.5787	4436.2997	3798.3563	2983.3246	2394.5968	2157.7940 (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	53.5901	53.7040	53.8161	54.3491	54.4500	54.9246	54.9246	55.0134	54.7408	54.4500	54.2463	54.0349
alpha	4.5727	4.5803	4.5877	4.6233	4.6300	4.6616	4.6616	4.6676	4.6494	4.6300	4.6164	4.6023
util living area	0.9999	0.9996	0.9984	0.9918	0.9636	0.8758	0.7403	0.8142	0.9648	0.9973	0.9997	0.9999 (86)
MIT	19.0640	19.2443	19.5586	20.0129	20.4576	20.7971	20.9356	20.8979	20.5962	20.0273	19.4722	19.0433 (87)
Th 2	19.9787	19.9806	19.9825	19.9915	19.9932	20.0010	20.0010	20.0025	19.9980	19.9932	19.9898	19.9862 (88)
util rest of house	0.9998	0.9994	0.9978	0.9884	0.9461	0.8110	0.6112	0.6996	0.9401	0.9959	0.9996	0.9999 (89)
MIT 2	17.6718	17.9044	18.3087	18.8954	19.4536	19.8495	19.9722	19.9495	19.6341	18.9169	18.2031	17.6503 (90)
Living area fraction	17.7369	17.9671	18.3671	18.9477	19.5005	19.8938	20.0173	19.9938	19.6791	18.9688	18.2624	17.7154 (92)
MIT	17.7369	17.9671	18.3671	18.9477	19.5005	19.8938	20.0173	19.9938	19.6791	18.9688	18.2624	17.7154 (93)
Temperature adjustment												0.0000
adjusted MIT	17.7369	17.9671	18.3671	18.9477	19.5005	19.8938	20.0173	19.9938	19.6791	18.9688	18.2624	17.7154 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9997	0.9989	0.9963	0.9830	0.9343	0.8024	0.6136	0.6984	0.9285	0.9934	0.9992	0.9998 (94)
Useful gains	2316.2066	2997.0711	3668.6496	4471.7254	4843.1364	4216.3291	3065.1530	3098.3544	3526.6603	2963.5581	2392.7256	2157.3273 (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	13008.9732	12624.1079	11440.9605	9591.8125	7432.8301	5000.6641	3228.0682	3389.3350	5287.8466	7974.3364	10676.1915	12977.2850 (97)
Space heating kWh	7955.4183	6469.3687	5782.5993	3686.4627	1926.7321	0.0000	0.0000	0.0000	0.0000	3728.0190	5964.0954	8050.0485 (98a)
Space heating requirement - total per year (kWh/year)												43562.7442
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	7955.4183	6469.3687	5782.5993	3686.4627	1926.7321	0.0000	0.0000	0.0000	0.0000	3728.0190	5964.0954	8050.0485 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												43562.7442
Space heating per m2										(98c) / (4) =		50.7180 (99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												92.3000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	7955.4183	6469.3687	5782.5993	3686.4627	1926.7321	0.0000	0.0000	0.0000	0.0000	3728.0190	5964.0954	8050.0485 (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)	8619.0881	7009.0669	6265.0047	3994.0008	2087.4671	0.0000	0.0000	0.0000	0.0000	4039.0239	6461.6418	8721.6127 (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	305.3049	269.8269	286.6123	252.3371	244.7365	220.7039	218.1402	226.8327	229.3133	255.4487	271.2368	302.0562 (64)
Efficiency of water heater	88.4314	88.4008	88.3296	88.1630	87.6854	79.8000	79.8000	79.8000	79.8000	88.1624	88.3665	79.8000 (216)
Fuel for water heating, kWh/month	345.2450	305.2312	324.4807	286.2165	279.1074	276.5713	273.3587	284.2515	287.3600	289.7480	306.9454	341.5408 (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	95.0448	76.2485	68.6533	50.2983	38.8519	31.7423	35.4420	46.0688	59.8389	78.5118	88.6789	97.6864 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-196.7828	-263.1083	-358.4340	-380.5886	-391.5126	-357.8072	-352.3318	-341.0169	-319.5526	-288.7540	-210.7114	-171.7589 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)

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Electricity generated by PVs (Appendix M) (negative quantity)													
(233b)m	-159.0170	-327.6356	-639.4189	-944.2546	-1233.9982	-1235.6246	-1222.0380	-1042.0858	-773.1175	-464.2244	-210.7371	-126.3729	(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												47196.9059	(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												3600.0563	(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)												767.0660	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-12010.8838	(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												39639.1444	(238)

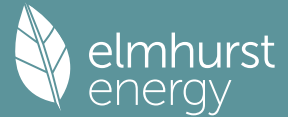
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	47196.9059	0.2100	9911.3502 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3600.0563	0.2100	756.0118 (264)
Space and water heating			10667.3621 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	767.0660	0.1443	110.7113 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3632.3592	0.1358	-493.4269
PV Unit electricity exported	-8378.5246	0.1264	-1058.9067
Total			-1552.3336 (269)
Total CO2, kg/year			9237.6691 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.7500 (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	47196.9059	1.1300	53332.5037 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3600.0563	1.1300	4068.0637 (278)
Space and water heating			57400.5673 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	767.0660	1.5338	1176.5514 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3632.3592	1.5021	-5456.2344
PV Unit electricity exported	-8378.5246	0.4639	-3887.0839
Total			-9343.3182 (283)
Total Primary energy kWh/year			49363.9013 (286)
Target Primary Energy Rate (TPER)			57.4700 (287)

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Property Reference	12434				Issued on Date	30/09/2024	
Assessment Reference	Be Green RETAINED 0.30			Prop Type Ref	Detached House		
Property	41, Sheldon Avenue, London, N6 4JP						
SAP Rating	85 B		DER	2.28		TER	10.07
Environmental	97 A		% DER < TER				77.36
CO ₂ Emissions (t/year)	1.8		DFEE	49.37		TFEE	51.40
Compliance Check	See BREL		% DFEE < TFEE				3.95
% DPER < TPER	52.98		DPER	25.28		TPER	53.76
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	243.6000 (1a)	x 2.9000 (2a)	= 706.4400 (1a) - (3a)
Ground floor	298.1000 (1b)	x 3.8500 (2b)	= 1147.6850 (1b) - (3b)
First floor	222.8000 (1c)	x 3.2200 (2c)	= 717.4160 (1c) - (3c)
Second floor	106.3000 (1d)	x 2.6900 (2d)	= 285.9470 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 2857.4880 (5)

2. Ventilation rate

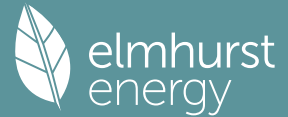
											m3 per hour	
Number of open chimneys											0 * 80 =	0.0000 (6a)
Number of open flues											0 * 20 =	0.0000 (6b)
Number of chimneys / flues attached to closed fire											0 * 10 =	0.0000 (6c)
Number of flues attached to solid fuel boiler											0 * 20 =	0.0000 (6d)
Number of flues attached 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											3.0000 (17)	
Infiltration rate											0.1500 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1500 (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												
	0.1912	0.1875	0.1837	0.1650	0.1612	0.1425	0.1425	0.1388	0.1500	0.1612	0.1687	0.1762 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation												
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a)												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3592	0.3555	0.3518	0.3330	0.3292	0.3105	0.3105	0.3067	0.3180	0.3292	0.3367	0.3442 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
Door			7.8500	1.0000	7.8500		(26)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1100	26.5661	110.0000	26566.1000 (28)
Ground floor			102.9200	0.1100	11.3212	110.0000	11321.2000 (28a)
Exposed floor to garage			10.8400	0.1524	1.6518	20.0000	216.8000 (28b)
Basement Wall	189.0000		189.0000	0.1300	24.5700	9.0000	1701.0000 (29a)
External Wall	432.5000	76.9700	355.5300	0.1300	46.2189	150.0000	53329.5000 (29a)
Stud Wall	231.0000		231.0000	0.0800	18.4800	18.0000	4158.0000 (29a)

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												
Hot water usage for mixer showers												3.8740 (42)
Hot water usage for baths	111.4673	109.7922	107.3512	102.6808	99.2341	95.3904	93.2057	95.6282	98.2838	102.4107	107.1814	111.0402 (42a)
Hot water usage for other uses	38.4709	37.8995	37.0950	35.6115	34.5007	33.2689	32.6036	33.4026	34.2725	35.5905	37.1045	38.3408 (42b)
Average daily hot water use (litres/day)	54.3033	52.3287	50.3540	48.3793	46.4047	44.4300	44.4300	46.4047	48.3793	50.3540	52.3287	54.3033 (42c)
												187.8044 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	204.2415	200.0204	194.8001	186.6716	180.1394	173.0894	170.2393	175.4354	180.9355	188.3551	196.6146	203.6844 (44)
Energy content (annual)	323.4687	284.8264	299.4006	255.5440	242.5023	212.8336	205.8897	217.2257	223.1116	255.5962	280.1135	318.9205 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum(45)m =											3119.4327
Water storage loss:	48.5203	42.7240	44.9101	38.3316	36.3753	31.9250	30.8835	32.5839	33.4667	38.3394	42.0170	47.8381 (46)
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7560 (55)
Total storage loss	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (56)
If cylinder contains dedicated solar storage	23.4360	21.1680	23.4360	22.6800	23.4360	22.6800	23.4360	23.4360	22.6800	23.4360	22.6800	23.4360 (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	370.1671	327.0056	346.0990	300.7360	289.2007	258.0256	252.5881	263.9241	268.3036	302.2946	325.3055	365.6189 (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	370.1671	327.0056	346.0990	300.7360	289.2007	258.0256	252.5881	263.9241	268.3036	302.2946	325.3055	365.6189 (64)
12Total per year (kWh/year)	Total per year (kWh/year) = Sum(64)m =											3669.2687 (64)
Electric shower(s)												3669 (64)

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (64a)
	Total Energy used by instantaneous electric shower(s) (kWh/year) = Sum(64a)m =											0.0000 (64a)
Heat gains from water heating, kWh/month	144.9121	128.4481	136.9094	121.1220	117.9907	106.9208	105.8170	109.5863	110.3382	122.3444	129.2913	143.3998 (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
	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588 (71)
Water heating gains (Table 5)												
	194.7743	191.1430	184.0180	168.2250	158.5897	148.5011	142.2272	147.2934	153.2475	164.4415	179.5713	192.7417 (72)
Total internal gains	1575.7224	1630.3507	1551.7620	1504.7876	1420.9006	1370.9434	1312.3092	1308.6882	1351.9562	1394.3316	1483.7131	1536.7520 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				5.8300	11.2829	0.4000	0.0000	0.7700	20.2601 (75)			
East				1.8000	19.6403	0.4000	0.0000	0.7700	10.8886 (76)			
Southeast				24.3800	36.7938	0.4000	0.0000	0.7700	276.2864 (77)			
South				1.8000	46.7521	0.4000	0.0000	0.7700	25.9193 (78)			
Southwest				14.1600	36.7938	0.4000	0.0000	0.7700	160.4682 (79)			
Northwest				53.5100	11.2829	0.4000	0.0000	0.7700	185.9551 (81)			
Horizontal				7.7000	26.0000	0.4000	0.0000	1.0000	80.0800 (82)			
Solar gains	759.8576	1393.7811	2159.0110	3077.5254	3799.9437	3923.8196	3720.2779	3160.7323	2475.1907	1609.5447	928.5434	638.2075 (83)
Total gains	2335.5800	3024.1318	3710.7730	4582.3129	5220.8443	5294.7630	5032.5871	4469.4206	3827.1469	3003.8762	2412.2564	2174.9595 (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	46.9333	47.1465	47.3618	48.4680	48.6955	49.8657	49.8657	50.1066	49.3910	48.6955	48.2427	47.7981
alpha	4.1289	4.1431	4.1575	4.2312	4.2464	4.3244	4.3244	4.3404	4.2927	4.2464	4.2162	4.1865
util living area	0.9993	0.9979	0.9933	0.9726	0.9071	0.7617	0.6056	0.6838	0.9081	0.9894	0.9985	0.9995 (86)
Living	19.3861	19.5585	19.8398	20.2464	20.5982	20.8301	20.9009	20.8833	20.6881	20.2225	19.7468	19.3800
Non living	18.2181	18.4416	18.8044	19.3340	19.7696	20.0437	20.1075	20.0988	19.8922	19.3100	18.6962	18.2205
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	20.1744	19.5585	19.8398	20.2464	20.5982	20.8301	20.9009	20.8833	20.6881	20.2225	19.7468	19.6066 (87)
Th 2	20.1695	20.1729	20.1764	20.1937	20.1972	20.2146	20.2146	20.2181	20.2076	20.1972	20.1902	20.1833 (88)
util rest of house	0.9992	0.9974	0.9917	0.9655	0.8819	0.7002	0.5121	0.5922	0.8730	0.9858	0.9981	0.9994 (89)
MIT 2	19.3915	18.4416	18.8044	19.3340	19.7696	20.0437	20.1075	20.0988	19.8922	19.3100	18.6962	18.5742 (90)
Living area fraction									fLA = Living area / (4) =			0.0461 (91)
MIT	19.4277	18.4932	18.8521	19.3761	19.8078	20.0800	20.1441	20.1350	19.9289	19.3521	18.7447	18.6218 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4277	18.4932	18.8521	19.3761	19.8078	20.0800	20.1441	20.1350	19.9289	19.3521	18.7447	18.6218 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9990	0.9960	0.9880	0.9560	0.8671	0.6885	0.5031	0.5815	0.8575	0.9804	0.9970	0.9991 (94)
Useful gains	2333.2654	3012.0517	3666.1681	4380.8814	4526.8928	3645.2222	2532.0615	2599.0487	3281.6778	2944.8918	2404.9528	2173.0364 (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	11825.3054	10577.7284	9568.3282	7929.8864	6108.4961	4031.7974	2607.4939	2734.7710	4329.7142	6593.9491	8855.5849	11069.5405 (97)
Space heating kWh	7062.0777	5084.1347	4391.2071	2555.2836	1176.7129	0.0000	0.0000	0.0000	0.0000	2714.8986	4644.4551	6618.9991 (98a)
Space heating requirement - total per year (kWh/year)												34247.7688
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	7062.0777	5084.1347	4391.2071	2555.2836	1176.7129	0.0000	0.0000	0.0000	0.0000	2714.8986	4644.4551	6618.9991 (98c)
Space heating requirement after solar contribution - total per year (kWh/year)												34247.7688
Space heating per m2										(98c) / (4) =		39.3291 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	6915.8742	5444.4116	5564.6832	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7355	0.8178	0.7569	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	5086.5270	4452.2235	4211.9252	0.0000	0.0000	0.0000	0.0000 (102)

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Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	5809.8653	5520.2676	4891.0576	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	520.8036	794.6247	505.2745	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction	0.0000	0.0000	0.0000	0.0000	0.0000	520.8036	794.6247	505.2745	0.0000	0.0000	0.0000	0.0000 (104)
Intermittency factor (Table 10b)	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.2500	0.1837 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	23.9230	36.5009	23.2097	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling requirement	0.0000	0.0000	0.0000	0.0000	0.0000	23.9230	36.5009	23.2097	0.0000	0.0000	0.0000	0.0000 (107)
												83.6336 (107)

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 %)												372.3146 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Cooling System Energy Efficiency Ratio (see Table 10c)												5.0000 (209)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	7062.0777	5084.1347	4391.2071	2555.2836	1176.7129	0.0000	0.0000	0.0000	0.0000	2714.8986	4644.4551	6618.9991 (98)
Space heating efficiency (main heating system 1)	372.3146	372.3146	372.3146	372.3146	372.3146	0.0000	0.0000	0.0000	0.0000	372.3146	372.3146	372.3146 (210)
Space heating fuel (main heating system)	1896.8036	1365.5479	1179.4344	686.3237	316.0533	0.0000	0.0000	0.0000	0.0000	729.1947	1247.4543	1777.7971 (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	370.1671	327.0056	346.0990	300.7360	289.2007	258.0256	252.5881	263.9241	268.3036	302.2946	325.3055	365.6189 (64)
Efficiency of water heater	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690	180.6690 (216)
Fuel for water heating, kWh/month	204.8868	180.9970	191.5652	166.4569	160.0721	142.8167	139.8071	146.0815	148.5056	167.3195	180.0560	202.3694 (219)
Space cooling fuel requirement	0.0000	0.0000	0.0000	0.0000	0.0000	4.7846	7.3002	4.6419	0.0000	0.0000	0.0000	0.0000 (221)
Pumps and Fa	435.2416	393.1215	435.2416	421.2016	435.2416	421.2016	435.2416	435.2416	421.2016	435.2416	421.2016	435.2416 (231)
Lighting	125.7565	100.8865	90.8371	66.5512	51.4060	41.9992	46.8943	60.9550	79.1745	103.8812	117.3336	129.2516 (232)
Electricity generated by PVs (Appendix M) (negative quantity)	-95.7634	-154.0775	-253.8873	-316.3894	-355.6698	-321.8256	-317.9864	-287.1707	-234.8649	-185.8156	-110.1841	-80.0088 (233a)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234a)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235a)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235c)
Electricity generated by PVs (Appendix M) (negative quantity)	-18.4032	-46.0865	-109.9851	-200.2283	-304.4916	-335.4101	-327.1604	-262.4904	-175.2580	-76.5700	-27.2017	-14.1661 (233b)
Electricity generated by wind turbines (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (234b)
Electricity generated by hydro-electric generators (Appendix M) (negative quantity)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235b)
Electricity used or net electricity generated by micro-CHP (Appendix N) (negative if net generation)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (235d)
Annual totals kWh/year												
Space heating fuel - main system 1												9198.6091 (211)
Space heating fuel - main system 2												0.0000 (213)
Space heating fuel - secondary												0.0000 (215)
Efficiency of water heater												180.6690
Water heating fuel used												2030.9338 (219)
Space cooling fuel												16.7267 (221)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 1.4700)												
mechanical ventilation fans (SFP = 1.4700)												5124.6190 (230a)
Total electricity for the above, kWh/year												5124.6190 (231)
Electricity for lighting (calculated in Appendix L)												1014.9267 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV generation												-4611.0948 (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												12774.7204 (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	9198.6091	0.1549	1425.3005 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	2030.9338	0.1411	286.6639 (264)
Space and water heating			1711.9644 (265)
Space cooling	16.7267	0.1139	1.9044 (266)
Pumps, fans and electric keep-hot	5124.6190	0.1387	710.8478 (267)
Energy for lighting	1014.9267	0.1443	146.4853 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2713.6434	0.1330	-360.9810
PV Unit electricity exported	-1897.4514	0.1206	-228.8219
Total			-589.8029 (269)
Total CO2, kg/year			1981.3990 (272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.2800 (273)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	9198.6091	1.5736	14475.2261 (275)
Total CO ₂ associated with community systems			0.0000 (473)
Water heating (other fuel)	2030.9338	1.5219	3090.9384 (278)
Space and water heating			17566.1645 (279)
Space cooling	16.7267	1.4197	23.7469 (280)
Pumps, fans and electric keep-hot	5124.6190	1.5128	7752.5236 (281)
Energy for lighting	1014.9267	1.5338	1556.7284 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-2713.6434	1.4916	-4047.5809
PV Unit electricity exported	-1897.4514	0.4423	-839.3095
Total			-4886.8903 (283)
Total Primary energy kWh/year			22012.2731 (286)
Dwelling Primary energy Rate (DPER)			25.2800 (287)

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

1. Overall dwelling characteristics

	Area (m ²)	Storey height (m)	Volume (m ³)
Basement floor	243.6000 (1a)	x 2.9000 (2a)	= 706.4400 (1a) - (3a)
Ground floor	298.1000 (1b)	x 3.8500 (2b)	= 1147.6850 (1b) - (3b)
First floor	222.8000 (1c)	x 3.2200 (2c)	= 717.4160 (1c) - (3c)
Second floor	106.3000 (1d)	x 2.6900 (2d)	= 285.9470 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	870.8000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 2857.4880 (5)

2. Ventilation rate

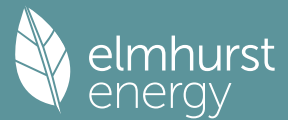
	m ³ per hour
Number of open chimneys	0 * 80 = 0.0000 (6a)
Number of open flues	0 * 20 = 0.0000 (6b)
Number of chimneys / flues attached to closed fire	0 * 10 = 0.0000 (6c)
Number of flues attached to solid fuel boiler	0 * 20 = 0.0000 (6d)
Number of flues attached to other heater	0 * 35 = 0.0000 (6e)
Number of blocked chimneys	0 * 20 = 0.0000 (6f)
Number of intermittent extract fans	4 * 10 = 40.0000 (7a)
Number of passive vents	0 * 10 = 0.0000 (7b)
Number of flueless gas fires	0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) = 0.0140 (8)
Pressure test	Yes
Pressure Test Method	Blower Door
Measured/design AP50	5.0000 (17)
Infiltration rate	0.2640 (18)
Number of sides sheltered	0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) = 0.2640 (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	0.3366	0.3300	0.3234	0.2904	0.2838	0.2508	0.2508	0.2442	0.2640	0.2838	0.2970	0.3102 (22b)
Effective ac	0.5566	0.5544	0.5523	0.5422	0.5403	0.5314	0.5314	0.5298	0.5348	0.5403	0.5441	0.5481 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			7.8500	1.0000	7.8500		(26)
TER Opening Type (Uw = 1.20)			101.4800	1.1450	116.1985		(27)
RL1-RL3 (Basement)			3.4200	1.5918	5.4438		(27a)
RL4 (Pantry)			1.2500	1.5918	1.9897		(27a)
RL5 (SF Hallway)			2.3400	1.5918	3.7247		(27a)
RL6 (SF En Suite)			0.6900	1.5918	1.0983		(27a)
Basement floor			241.5100	0.1300	31.3963		(28)
Ground floor			102.9200	0.1300	13.3796		(28a)
Exposed floor to garage			10.8400	0.1300	1.4092		(28b)
Basement Wall	189.0000		189.0000	0.1800	34.0200		(29a)
External Wall	432.5000	76.9700	355.5300	0.1800	63.9954		(29a)
Stud Wall	231.0000		231.0000	0.1800	41.5800		(29a)
Dormer Walls	7.2000	6.2800	0.9200	0.1800	0.1656		(29a)
Wall to garage	38.5400		38.5400	0.1800	6.9372		(29a)
Retained Front Facade	97.5000	26.0800	71.4200	0.1800	12.8556		(29a)
Pitch Roof	182.0000		182.0000	0.1100	20.0200		(30)
Flat Roof	103.2800	4.2800	99.0000	0.1100	10.8900		(30)
Flat Blue Roof	29.3200		29.3200	0.1100	3.2252		(30)
Dormer Roof	8.8500		8.8500	0.1100	0.9735		(30)
Ceiling to loft void	125.9100		125.9100	0.1100	13.8501		(30)
Basement ceiling to garage	23.6400		23.6400	0.1100	2.6004		(30)
Basement ceiling garden rear	23.1700	3.4200	19.7500	0.1100	2.1725		(30)

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Total net area of external elements Aum(A, m2) 1847.1800 (31)
Fabric heat loss, W/K = Sum (A x U) (26)...(30) + (32) = 395.7756 (33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 151.6720 (35)

List of Thermal Bridges			
K1 Element	Length	Psi-value	Total
E2 Other lintels (including other steel lintels)	59.0500	0.0500	2.9525
E3 Sill	55.8000	0.0500	2.7900
E4 Jamb	199.5000	0.0500	9.9750
E5 Ground floor (normal)	50.8400	0.1600	8.1344
E19 Ground floor (inverted)	14.1300	0.0700	0.9891
E20 Exposed floor (normal)	6.6100	0.3200	2.1152
E21 Exposed floor (inverted)	6.6100	0.3200	2.1152
E22 Basement floor	65.2000	0.0700	4.5640
E6 Intermediate floor within a dwelling	206.0500	0.0000	0.0000
E8 Balcony within a dwelling, wall insulation continuous	8.9500	0.0000	0.0000
E11 Eaves (insulation at rafter level)	50.4300	0.0400	2.0172
E14 Flat roof	96.8000	0.0800	7.7440
E16 Corner (normal)	71.6900	0.0900	6.4521
E17 Corner (inverted - internal area greater than external area)	43.0500	-0.0900	-3.8745
R1 Head of roof window	5.5000	0.0800	0.4400
R2 Sill of roof window	5.5000	0.0600	0.3300
R3 Jamb of roof window	11.6000	0.0800	0.9280
R4 Ridge (vaulted ceiling)	2.9700	0.0800	0.2376
R5 Ridge (inverted)	13.0000	0.0400	0.5200
R6 Flat ceiling	35.7500	0.0600	2.1450
R7 Flat ceiling (inverted)	6.6000	0.0400	0.2640
R9 Roof to wall (flat ceiling)	6.6000	0.0400	0.2640
E16 Corner (normal)	28.2800	0.0900	2.5452
E17 Corner (inverted - internal area greater than external area)	29.5400	-0.0900	-2.6586
E5 Ground floor (normal)	14.3600	0.1600	2.2976
E6 Intermediate floor within a dwelling	13.1100	0.0000	0.0000

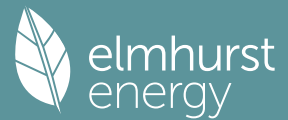
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 53.2870 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 449.0626 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	524.9039	522.8296	520.7964	511.2464	509.4596	501.1419	501.1419	499.6016	504.3458	509.4596	513.0743	516.8532
Heat transfer coeff	973.9666	971.8923	969.8590	960.3090	958.5223	950.2045	950.2045	948.6642	953.4084	958.5223	962.1369	965.9158
Average = Sum(39)m / 12 =												960.3005
HLP	Jan 1.1185	Feb 1.1161	Mar 1.1138	Apr 1.1028	May 1.1007	Jun 1.0912	Jul 1.0912	Aug 1.0894	Sep 1.0949	Oct 1.1007	Nov 1.1049	Dec 1.1092
HLP (average)												1.1028
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)												
Assumed occupancy												3.8740 (42)
Hot water usage for mixer showers	89.1739	87.8337	85.8809	82.1446	79.3873	76.3123	74.5646	76.5026	78.6270	81.9286	85.7451	88.8322 (42a)
Hot water usage for baths	38.4709	37.8995	37.0950	35.6115	34.5007	33.2689	32.6036	33.4026	34.2725	35.5905	37.1045	38.3408 (42b)
Hot water usage for other uses	54.3033	52.3287	50.3540	48.3793	46.4047	44.4300	44.4300	46.4047	48.3793	50.3540	52.3287	54.3033 (42c)
Average daily hot water use (litres/day)												167.2505 (43)
Daily hot water use	Jan 181.9481	Feb 178.0619	Mar 173.3299	Apr 166.1354	May 160.2926	Jun 154.0113	Jul 151.5982	Aug 156.3098	Sep 161.2788	Oct 167.8730	Nov 175.1783	Dec 181.4764 (44)
Energy conte	288.1613	253.5578	266.4016	227.4311	215.7846	189.3748	183.3448	193.5442	198.8729	227.8021	249.5736	284.1481 (45)
Energy content (annual)										Total = Sum(45)m =		2777.9969
Distribution loss (46)m = 0.15 x (45)m	43.2242	38.0337	39.9602	34.1147	32.3677	28.4062	27.5017	29.0316	29.8309	34.1703	37.4360	42.6222 (46)
Water storage loss:												
Store volume												300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.1409 (55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664 (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	346.7901	306.5129	325.0304	284.1686	274.4135	246.1124	241.9736	252.1730	255.6104	286.4309	306.3112	342.7769 (62)
WWHRS	-40.7666	-36.0543	-37.7540	-31.2618	-29.1349	-24.9309	-23.3687	-24.8503	-25.7945	-30.4088	-34.4495	-40.0116 (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	306.0235	270.4586	287.2765	252.9069	245.2786	221.1815	218.6049	227.3227	229.8160	256.0221	271.8617	302.7653 (64)
12Total per year (kWh/year)										Total per year (kWh/year) = Sum(64)m =		3089.5181 (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	142.7167	126.6720	135.4816	121.0109	118.6514	108.3572	107.8652	111.2565	111.5153	122.6472	128.3733	141.3823 (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	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985	193.6985 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	462.6759	512.2483	462.6759	478.0984	462.6759	478.0984	462.6759	462.6759	478.0984	462.6759	478.0984	462.6759 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	837.1627	845.8498	823.9585	777.3546	718.5255	663.2344	626.2966	617.6094	639.5007	686.1047	744.9338	800.2249 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698	42.3698 (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)

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Losses e.g. evaporation (negative values) (Table 5)	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588	-154.9588 (71)
Water heating gains (Table 5)	191.8235	188.5000	182.0989	168.0707	159.4777	150.4961	144.9801	149.5383	154.8823	164.8484	178.2962	190.0300 (72)
Total internal gains	1575.7716	1630.7077	1552.8429	1507.6332	1424.7887	1372.9384	1315.0621	1310.9332	1353.5910	1397.7385	1485.4380	1537.0403 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
Northeast					5.8300	11.2829		0.6300	0.7000		0.7700	20.1031 (75)	
East					1.8000	19.6403		0.6300	0.7000		0.7700	10.8042 (76)	
Southeast					24.3800	36.7938		0.6300	0.7000		0.7700	274.1451 (77)	
South					1.8000	46.7521		0.6300	0.7000		0.7700	25.7185 (78)	
Southwest					14.1600	36.7938		0.6300	0.7000		0.7700	159.2246 (79)	
Northwest					53.5100	11.2829		0.6300	0.7000		0.7700	184.5139 (81)	
Horizontal					7.7000	26.0000		0.6300	0.7000		1.0000	79.4594 (82)	
Solar gains	753.9687	1382.9793	2142.2787	3053.6745	3770.4941	3893.4100	3691.4457	3136.2367	2456.0080	1597.0707	921.3472	633.2614	(83)
Total gains	2329.7404	3013.6870	3695.1215	4561.3078	5195.2828	5266.3484	5006.5078	4447.1698	3809.5990	2994.8092	2406.7851	2170.3017	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	37.6684	37.7488	37.8280	38.2041	38.2754	38.6104	38.6104	38.6731	38.4807	38.2754	38.1316	37.9824	
alpha	3.5112	3.5166	3.5219	3.5469	3.5517	3.5740	3.5740	3.5782	3.5654	3.5517	3.5421	3.5322	
util living area	0.9991	0.9975	0.9933	0.9776	0.9329	0.8338	0.7063	0.7741	0.9346	0.9902	0.9981	0.9993 (86)	
MIT	18.4891	18.7212	19.1254	19.7046	20.2638	20.6933	20.8830	20.8328	20.4528	19.7324	19.0163	18.4611 (87)	
Th 2	19.9858	19.9877	19.9896	19.9986	20.0002	20.0080	20.0080	20.0095	20.0050	20.0002	19.9968	19.9933 (88)	
util rest of house	0.9989	0.9970	0.9916	0.9712	0.9108	0.7717	0.5911	0.6704	0.9034	0.9866	0.9976	0.9991 (89)	
MIT 2	16.9921	17.2908	17.8095	18.5528	19.2514	19.7578	19.9431	19.9063	19.4960	18.5937	17.6750	16.9607 (90)	
Living area fraction									FLA = Living area / (4) =			0.0461 (91)	
MIT	17.0612	17.3568	17.8702	18.6059	19.2981	19.8009	19.9864	19.9490	19.5401	18.6462	17.7369	17.0299 (92)	
Temperature adjustment												0.0000	
adjusted MIT	17.0612	17.3568	17.8702	18.6059	19.2981	19.8009	19.9864	19.9490	19.5401	18.6462	17.7369	17.0299 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	2324.4403	2996.6327	3642.5021	4369.1964	4623.7732	3980.7746	2944.8179	2947.3592	3364.0532	2930.2916	2395.8458	2166.4955 (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	12428.9347	12106.6606	11027.5391	9320.6893	7282.9426	4941.9462	3217.7862	3366.8325	5186.6686	7712.4818	10234.1543	12392.5732 (97)	
Space heating kWh	7517.7439	6121.9387	5494.4676	3565.0749	1978.4220	0.0000	0.0000	0.0000	0.0000	3557.9496	5643.5821	7608.2018 (98a)	
Space heating requirement - total per year (kWh/year)												41487.3806	
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	7517.7439	6121.9387	5494.4676	3565.0749	1978.4220	0.0000	0.0000	0.0000	0.0000	3557.9496	5643.5821	7608.2018 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												41487.3806	
Space heating per m2										(98c) / (4) =		47.6428 (99)	

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.3000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	7517.7439	6121.9387	5494.4676	3565.0749	1978.4220	0.0000	0.0000	0.0000	0.0000	3557.9496	5643.5821	7608.2018 (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)	8144.9012	6632.6530	5952.8359	3862.4864	2143.4692	0.0000	0.0000	0.0000	0.0000	3854.7666	6114.3901	8242.9056 (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	306.0235	270.4586	287.2765	252.9069	245.2786	221.1815	218.6049	227.3227	229.8160	256.0221	271.8617	302.7653 (64)	
Efficiency of water heater (217)m	88.4100	88.3783	88.3052	88.1415	87.7089	79.8000	79.8000	79.8000	79.8000	88.1328	88.3421	88.4184 (217)	
Fuel for water heating, kWh/month	346.1413	306.0238	325.3224	286.9327	279.6508	277.1698	273.9410	284.8655	287.9899	290.4959	307.7374	342.4236 (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	96.1349	77.1230	69.4407	50.8752	39.2975	32.1064	35.8485	46.5972	60.5252	79.4123	89.6960	98.8068 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													

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(233a)m	-197.6255	-264.4063	-360.4289	-382.9514	-394.1361	-360.2710	-354.7627	-343.2823	-321.5254	-290.3090	-211.6789	-172.4735	(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	-159.0528	-327.7963	-639.8878	-945.1630	-1235.3883	-1237.0952	-1223.4945	-1043.2355	-773.8426	-464.5285	-210.8103	-126.3945	(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												44948.4080	(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												3608.6941	(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)												775.8638	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-12040.5403	(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												37378.4256	(238)

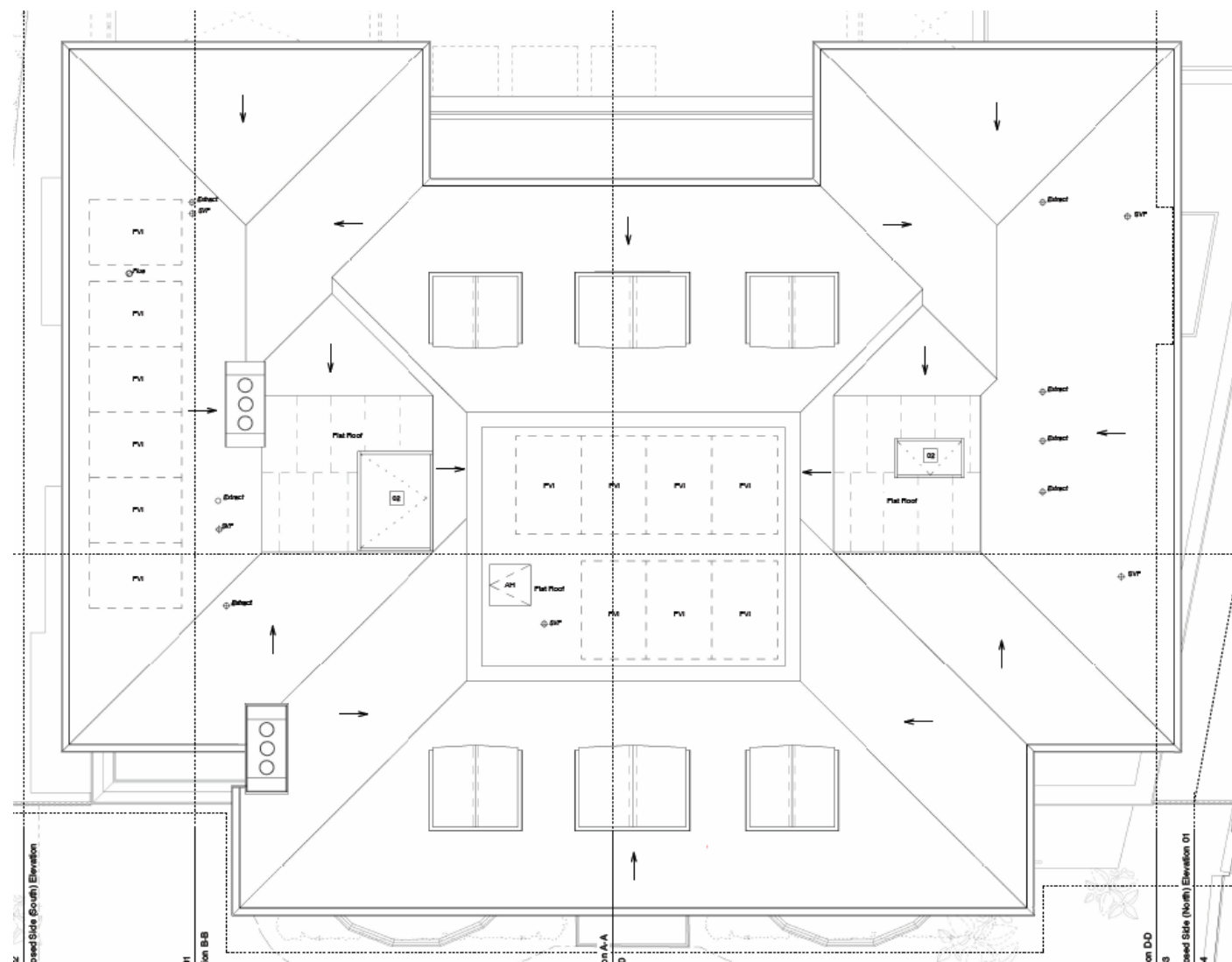
12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	44948.4080	0.2100	9439.1657 (261)
Total CO2 associated with community systems			0.0000 (373)
Water heating (other fuel)	3608.6941	0.2100	757.8258 (264)
Space and water heating			10196.9914 (265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293 (267)
Energy for lighting	775.8638	0.1443	111.9811 (268)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	0.1358	-496.2952
PV Unit electricity exported	-8386.6894	0.1264	-1059.8798
Total			-1556.1750 (269)
Total CO2, kg/year			8764.7268 (272)
EPC Target Carbon Dioxide Emission Rate (TER)			10.0700 (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	44948.4080	1.1300	50791.7010 (275)
Total CO2 associated with community systems			0.0000 (473)
Water heating (other fuel)	3608.6941	1.1300	4077.8243 (278)
Space and water heating			54869.5254 (279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008 (281)
Energy for lighting	775.8638	1.5338	1190.0458 (282)
Energy saving/generation technologies			
PV Unit electricity used in dwelling	-3653.8510	1.5021	-5488.3259
PV Unit electricity exported	-8386.6894	0.4639	-3890.6533
Total			-9378.9791 (283)
Total Primary energy kWh/year			46810.6929 (286)
Target Primary Energy Rate (TPER)			53.7600 (287)

13 Appendix 3 – Solar PV Roof plan



14 Appendix 4 – Daikin VRV REYQ22U Specifications

2-3 Technical Specifications				REYQ10U	REYQ13U	REYQ16U	REYQ18U	REYQ20U	REYQ22U	REYQ24U	REYQ26U	
Heating capacity	Rated,h		kW	16.0	21.7	23.2	27.9	31.0	34.4	36.9	37.1	
	Max.	6°CWB	kW	32.0 (2)	41.0 (2)	50.0 (2)	56.5 (2)	62.5 (2)	69.0 (2)	75.0 (2)	82.5 (2)	
SEER				7.0	7.6	7.3	6.9	6.7	6.6	6.5		
SEER recommended combination 2				7.1	7.5	7.3	6.8	6.4	6.5	6.4		
SEER recommended combination 3				6.9	7.4	7.1	6.9	6.8	6.6	6.5	6.6	
SCOP				4.0	4.1	4.3		4.5		4.3	4.5	
SCOP recommended combination 2				4.1	4.0	4.2		4.4	4.5	4.2	4.4	
SCOP recommended combination 3				4.1	4.2	4.1	4.2	4.4		4.1	4.3	
η _{s,c}			%	275.1	301.3	288.6	272.9	266.0	260.4	257.7	257.5	
η _{s,c} recommended combination 2				280.4	296.3	290.6	269.4	252.4	256.8	253.7	254.1	
η _{s,c} recommended combination 3				272.0	291.7	282.1	274.2	269.0	262.7	256.6	260.5	
η _{s,h}			%	158.8	160.6	168.2	167.9	175.7	178.5	167.6	175.5	
η _{s,h} recommended combination 2				160.2	157.6	164.5	166.0	173.3	176.4	164.3	172.5	
η _{s,h} recommended combination 3				161.0	166.5	160.4	165.0	171.9	174.1	162.1	168.6	
Capacity range			HP	10	13	16	18	20	22	24	26	
Maximum number of connectable indoor units				64 (3)								
Indoor index connection	Min.			125.0	163.0	200.0	225.0	250.0	275.0	300.0	325.0	
	Max.			325.0	423.0	520.0	585.0	650.0	715.0	780.0	845.0	
Capacity control	Method			Inverter controlled								
Heat exchanger	Indoor side			Air								
	Outdoor side			Air								
	Air flow rate	Cooling	Rated	m³/h	19,440		20,220		20,820	21,600	25,320	24,480
Sound power level	Heating	Rated	m³/h	19,440		20,220		20,820	21,600	25,320	24,480	
	Cooling	Nom.	dBA	81.0 (4)		81.6 (4)		84.5 (4)	84.8 (4)	86.3 (4)	85.3 (4)	
Sound pressure level	Heating	Nom.	dBA	65.7 (4)		66.9 (4)		67.8 (4)		69.6 (4)	69.9 (4)	
	Cooling	Nom.	dBA	60.0 (5)		60.0 (5)		62.5 (5)		64.0 (5)	63.5 (5)	
Refrigerant	Type			R-410A								
	GWP			2,087.5								
Refrigerant oil	Type			Synthetic (ether) oil FVC68D								
Piping connections	Liquid	Type		Brazed connection								
		OD	mm	9.52	12.7		15.9		19.1			
	Gas	Type		Brazed connection								
		OD	mm	22.2	28.6		34.9		39.9			
	HP/LP gas	Type		Brazing connections								
		OD	mm	19.1		22.2		28.6		34.9		
Total piping length			System	Actual	m	500 (6)		1,000 (6)				
Defrost method				Reversed cycle								
PED	Category			Category II								
Space cooling	A Condition (35°C - 27/19)	EERd		3.5	3.3	3.0	2.9	2.7	2.6	2.5	2.7	
		PdC	kW	28.0	36.4	44.8	50.4	55.9	61.5	67.4	73.5	
	B Condition (30°C - 27/19)	EERd		5.8	5.5	5.0	5.2	4.9		4.8	4.7	
		PdC	kW	20.6	26.8	33.0	37.1	41.2	45.3	49.7	54.2	
	C Condition (25°C - 27/19)	EERd		8.4	9.8	9.1	8.5	8.3	7.6	8.5	7.9	
		PdC	kW	16.8	17.2	21.2	23.9	26.5	29.1	31.9	34.8	
	D Condition (20°C - 27/19)	EERd		13.5	14.8	15.0	13.6	12.5	14.6	12.4	13.2	
		PdC	kW	9.6	10.0		17.8	11.8	18.2	17.3	17.6	
	A Condition (35°C - 27/19)	EERd		3.6	3.2	3.0	2.8	2.7	2.6	2.4	2.7	
		PdC	kW	28.0	36.4	44.8	50.4	55.9	61.5	67.4	73.5	
	B Condition (30°C - 27/19)	EERd		5.9	5.5	5.1	5.0	4.7				
		PdC	kW	20.6	26.8	33.0	37.1	41.2	45.3	49.7	54.2	
C Condition (25°C - 27/19)	EERd		8.5	9.5	9.2	8.5	7.8	7.5	8.5	7.8		
	PdC	kW	17.0	17.2	21.2	23.9	26.5	29.1	31.9	34.8		
D Condition (20°C - 27/19)	EERd		13.9	14.7	15.1	13.3	11.7	14.4	12.1	13.0		
	PdC	kW	9.8	10.0	10.1	17.7	11.8	18.1	17.2	17.5		

2-3 Technical Specifications				REYQ10U	REYQ13U	REYQ16U	REYQ18U	REYQ20U	REYQ22U	REYQ24U	REYQ26U
Space cooling recommended combination 3	A Condition (35°C - 27/19)	EERd		3.5	3.3	3.0	2.9	2.7	2.6	2.5	2.7
		PdC	kW	28.0	36.4	44.8	50.4	55.9	61.5	67.4	73.5
	B Condition (30°C - 27/19)	EERd		5.7	5.6	4.9	5.2	4.9	4.7	4.7	4.7
		PdC	kW	20.6	26.8	33.0	37.1	41.2	45.3	49.7	54.2
	C Condition (25°C - 27/19)	EERd		8.3	9.0	8.9	8.6	8.4	7.8	8.5	8.2
		PdC	kW	16.8	18.8	21.2	23.9	26.5	29.1	31.9	34.8
	D Condition (20°C - 27/19)	EERd		13.0	14.5	14.9	13.5	12.7	14.6	12.4	13.4
		PdC	kW	9.4	9.9	10.1	18.0	11.8	18.4	17.5	18.0
	Tbivalent	COPd (declared COP)		1.8	2.3	2.4		2.3		2.2	
		PdH (declared heating cap)	kW	16.0	21.7	23.2	27.9	31.0	34.4	36.9	39.0
		Tbiv (bivalent temperature)	°C	-10							
Space heating (Average climate)	TOL	COPd (declared COP)		1.8	2.3	2.4		2.3		2.2	
		PdH (declared heating cap)	kW	16.0	21.7	23.2	27.9	31.0	34.4	36.9	39.0
		Tol (temperature operating limit)	°C	-10							
	A Condition (-7°C)	COPd (declared COP)		1.9	2.6	2.7	2.6	2.8	2.7	2.8	2.8
		PdH (declared heating cap)	kW	14.2	19.2	20.5	24.7	27.4	30.4	32.6	34.5
	B Condition (2°C)	COPd (declared COP)		4.0	3.6	3.8	4.0	4.1	3.9	4.1	4.1
		PdH (declared heating cap)	kW	8.6	11.7	12.5	15.0	16.7	18.5	19.9	21.0
	C Condition (7°C)	COPd (declared COP)		6.1	6.2	6.3	6.0	6.6	6.7	6.3	6.7
		PdH (declared heating cap)	kW	5.7	7.5	8.0	11.3	12.2	12.3	12.8	13.7
	D Condition (12°C)	COPd (declared COP)		9.6	10.6	11.1	10.3	9.4	10.3	7.0	
		PdH (declared heating cap)	kW	8.9	9.1	9.2	7.0	7.7	7.0	5.7	6.0
Space heating (Average climate) recommended combination 2	A Condition (-7°C)	COPd (declared COP)		2.5		2.7	2.6	2.8	2.7	2.6	2.8
		PdH (declared heating cap)	kW	14.2	19.2	20.5	24.7	27.4	30.4	32.6	34.5
	B Condition (2°C)	COPd (declared COP)		3.9	3.6	3.7	3.9	4.1	3.9	4.1	4.1
		PdH (declared heating cap)	kW	8.6	11.7	12.5	15.0	16.7	18.5	19.9	21.0
	C Condition (7°C)	COPd (declared COP)		5.8	6.1		5.9	6.5	6.6	6.2	6.5
		PdH (declared heating cap)	kW	5.5	7.5	8.0	11.2	12.3	12.1	12.8	13.6
	D Condition (12°C)	COPd (declared COP)		9.1	10.4	10.8	10.3	9.1	10.3	6.8	6.9
		PdH (declared heating cap)	kW	8.7	9.0		6.9	7.6	6.9	5.7	6.0
	Tbivalent	COPd (declared COP)		2.3	2.2	2.3	2.2	2.3	2.2	2.1	2.2
		PdH (declared heating cap)	kW	16.0	21.7	23.2	27.9	31.0	34.4	36.9	39.0
		Tbiv (bivalent temperature)	°C	-10							
	TOL	COPd (declared COP)		2.3	2.2	2.3	2.2	2.3	2.2	2.1	2.2
		PdH (declared heating cap)	kW	16.0	21.7	23.2	27.9	31.0	34.4	36.9	39.0
		Tol (temperature operating limit)	°C	-10							