BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

Corner of Maryland Road and High Road
London
N22 5AR

Job number: 11577

Date: July 2024

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0	19/12/2023	ROB	PK	First Issue
1	17/07/2024	ROB	PK	Second Issue

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

Contents

1 Executive Summary

This report has been produced by Base Energy on behalf of Sleep Design Studio and in support of the planning application for the development named as corner of Maryland Road and High Road, London comprising of the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats falling under the requirements of Haringey Council.

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

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

The above policies require:

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

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

- Thermal specification exceeding Part L 2021 notional U-values
- A design which limits air permeability, targeting 3.5
- A design which limits thermal bridging by targeting the notional Y-value 0.05.
- Energy saving building services including Wastewater Heat Recovery, MVHR, low energy lighting and heating controls.
- Low carbon Air Source Heat Pumps

- Solar PV Panels

    - 2.4kWp for Flat 1 displayed at 30° angle on South pitch with little or no shading.
    - 2.4kWp for Flat 2 displayed at 30° angle on West pitch with little or no shading.
    - 2.4kWp for Flat 3 displayed at 30° angle on East pitch with little or no shading.
    - 2.4kWp for Flat 4 displayed at 30° angle on West pitch with little or no shading.
    - 2.4kWp for Flat 5 displayed at 30° angle on East pitch with little or no shading.
    - 2.4kWp for Flat 6 displayed at 30° angle on South pitch with little or no shading.

Table 1.1: Carbon emissions summary

	Total CO2 Emission (kg CO2/year)	CO2 saving (kg CO2/year)	Percentage savings (%)
Part L Baseline	5.4	NA	N/A
Be Lean Design	4.5	0.9	**16%**
Be Clean	4.5	0.9	**16%**
Be Green	0.2	4.3	**80%**
Cumulative saving	NA	5.2	**96%**

This results in an 96% 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 on the corner of Maryland Road and High Road, London

The development proposals are for the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats.

The development proposals constitute a minor development.

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

Figure 2.1: Site Location and proposals

3 Planning Policy

National Planning Policy Framework 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
    - 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-values[1] 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

SAP 10 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: Average Baseline CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	13.3	405	5,383

The **Total Baseline CO2 Emissions** for the development are shown to be 5,383 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

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

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

	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development
Walls	0.26	0.18	0.17
Ground Floor	0.18	0.13	0.11
Roof	0.16	0.11	0.10
Windows	1.6	1.2	1.2 & G Value 0.35
Doors to corridor	1.6	1.0	1.4
Air permeability	8.00	5.00	3.5

- Insulation: The specified building envelope is designed to meet and 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 targeting a global 'y-value' of 0.05.

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

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt.
- Space & Water Heating: Condensing gas boiler as per GLA requirements with an 89.5% efficiency boiler
- Heating Controls: Time and temperature zone control
- Ventilation: MVHR – Assumed model: EnviroVent EnergiSava 400 (SFP 0.61)
- Waster Water Heat Recovery: Assumed model – RECOUP Easyfit+ (Utilisation factor 0.97)

The specifications outlined above, and with the heating provided by a gas system 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

	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	13.3	405	5,383	5,383	N/A
Be Lean	12.7	405	5,160	4,511	**16%**

The CO2 Emissions reduction as a result of energy efficient fabric and services is shown to be 872 kg/year.

7 Low Carbon Technology Review & Recommendations

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

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

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

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

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

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

WIND TURBINES

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

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

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

GROUND SOURCE HEAT PUMP (GSHP)

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

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

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

AIR SOURCE HEAT PUMP (ASHP)

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

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

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

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

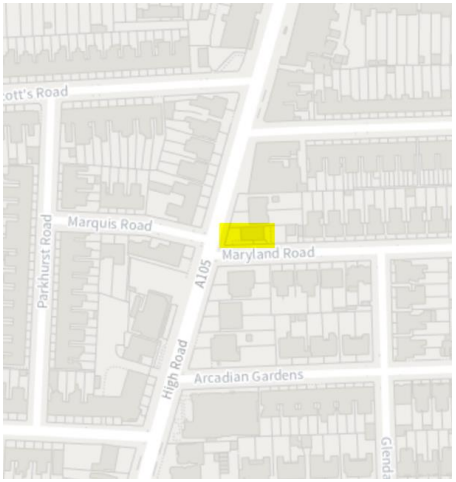
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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



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

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

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

SOLAR PHOTOVOLTAIC (PV)

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

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

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

SOLAR HOT WATER

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

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

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

Low Carbon Technology Summary

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

ASHP - Low carbon Air Source Heat Pumps with an efficiency of at least 300% air to water system.
Solar PV

- 2.4kWp for Flat 1 displayed at 30° angle on South pitch with little or no shading.
- 2.4kWp for Flat 2 displayed at 30° angle on West pitch with little or no shading.
- 2.4kWp for Flat 3 displayed at 30° angle on East pitch with little or no shading.
- 2.4kWp for Flat 4 displayed at 30° angle on West pitch with little or no shading.
- 2.4kWp for Flat 5 displayed at 30° angle on East pitch with little or no shading.
- 2.4kWp for Flat 6 displayed at 30° angle on South pitch with little or no shading.

As shown in Appendix 3, the roof space at Maryland Road has been fully utilised with Solar PV.

Both 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: Average Baseline vs Average Be Green CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	13.3	405	5,383	N/A
Lean & Green Design	0.5	405	197	**96%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 5,186 kg/year.

9 Zero Carbon Standard Summary

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

Haringey Council have stipulated that their price is £95 per tonne of carbon charged over a 30-year period. With the specification, we have used to achieve the average 92% 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	0.9	16%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	4.3	80%
Cumulative on site savings	**5.2**	**96%**
Annual savings from off-set payment	0.2	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**6**	-
Cash in-lieu contribution (£)	**563**	

*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 stage.

10 Conclusion

Proposals are for the development named as corner of Maryland Road and High Road, London comprising of the demolition of the existing building, and the construction of a new building (including lower ground floor) to comprise 6no. flats falling under the requirements of Haringey Council.

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

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

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

Low carbon technology will be incorporated and is to comprise ASHP with solar PV, 2.4kWp for each flat, totalling 14.4kWp for the total development.

This results in an 16% be lean saving, a 80% saving from low and zero carbon technology and a total 96% saving in CO2 over Part L 2021.

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 SAP Worksheets

Full SAP Calculation Printout

Property Reference	11577 1	**Issued on Date**	25/07/2024
Assessment Reference	Be Lean V4	**Prop Type Ref**	Flat 1
Property	Corner of, Maryland Road & High Road, London, N22		

SAP Rating	86 B	**DER**	10.45	**TER**	11.03
Environmental	90 B	**% DER < TER**			5.26
CO_2 Emissions (t/year)	1.05	**DFEE**	34.62	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			1.71
% DPER < TPER	-4.00	**DPER**	60.40	**TPER**	58.08

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.6600 (1b)	x	2.5000 (2b)	=	149.1500	(1b) - (3b)
First floor	53.9000 (1c)	x	2.5000 (2c)	=	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	283.9000	(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		3.5000	(17)
Infiltration rate		0.1750	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487	(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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748	(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) =		80.1000 (23c)

Effective ac	0.2892	0.2854	0.2817	0.2631	0.2594	0.2408	0.2408	0.2371	0.2482	0.2594	0.2668	0.2743	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Door			1.8900	1.4000	2.6460			(26)
Window (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1100	6.5626			(28a)
External Wall	91.0000	19.2300	71.7700	0.1700	12.2009			(29a)
Basement Wall	48.7500		48.7500	0.1700	8.2875			(29a)
Corridor Wall	19.2500		19.2500	0.1700	3.2725			(29a)
Ceiling to corridor	5.7600		5.7600	0.0970	0.5587			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.3831			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	11.2210	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	64.6041	(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	27.0902	26.7418	26.3934	24.6514	24.3030	22.5610	22.5610	22.2126	23.2578	24.3030	24.9998	25.6966	(38)
Heat transfer coeff	91.6943	91.3459	90.9975	89.2555	88.9071	87.1651	87.1651	86.8167	87.8619	88.9071	89.6039	90.3007	(39)
Average = Sum(39)m / 12 =												89.1684	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8075	0.8044	0.8013	0.7860	0.7829	0.7676	0.7676	0.7645	0.7737	0.7829	0.7890	0.7952	(40)
HLP (average)												0.7852	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8346	(42)
Hot water usage for mixer showers	89.6832	88.3354	86.3715	82.6138	79.8407	76.7482	74.9905	76.9395	79.0761	82.3965	86.2349	89.3396	(42a)
Hot water usage for baths	30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)
Hot water usage for other uses	43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)
Average daily hot water use (litres/day)												151.0951	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.3188	160.9234	156.7240	150.1842	144.9291	139.2572	136.9638	141.1438	145.5684	151.5376	158.1827	163.8705	(44)
Energy conte	260.2408	229.1528	240.8790	205.5947	195.1025	171.2330	165.6458	174.7655	179.5004	205.6351	225.3603	256.5816	(45)
Energy content (annual)										Total = Sum(45)m =		2509.6914	
Distribution loss (46)m = 0.15 x (45)m	39.0361	34.3729	36.1318	30.8392	29.2654	25.6850	24.8469	26.2148	26.9251	30.8453	33.8040	38.4872	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.8900	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0206	(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)
If cylinder contains dedicated solar storage	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	315.1418	278.7408	295.7800	258.7247	250.0035	224.3630	220.5468	229.6665	232.6304	260.5361	278.4903	311.4826	(62)
WWHRS	-52.0734	-46.0542	-48.2253	-39.9324	-37.2156	-31.8457	-29.8502	-31.7427	-32.9487	-38.8429	-44.0043	-51.1091	(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	263.0684	232.6866	247.5547	218.7923	212.7879	192.5174	190.6966	197.9237	199.6816	221.6932	234.4860	260.3735	(64)
										Total per year (kWh/year) = Sum(64)m =		2672.2618	(64)
12Total per year (kWh/year)												2672	(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	130.4509	115.8637	124.0131	110.8642	108.7924	99.4390	98.9980	102.0303	102.1879	112.2945	117.4363	129.2342	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	175.3372	172.4162	166.6842	153.9781	146.2263	138.1097	133.0619	137.1375	141.9276	150.9334	163.1060	173.7018	(72)
Total internal gains	667.3505	683.0409	654.3353	631.1298	599.0452	574.5594	552.4110	553.6167	570.5363	593.0415	629.5468	653.5120	(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	
East	10.1400	19.6403	0.3500	0.0000	0.7700	53.6715	(76)
South	7.2000	46.7521	0.3500	0.0000	0.7700	90.7177	(78)

Solar gains	144.3892	253.5651	362.1630	466.0754	531.9477	530.8765	510.7830	462.2609	398.7984	284.8320	174.4535	122.5253	(83)
Total gains	811.7398	936.6061	1016.4983	1097.2053	1130.9929	1105.4358	1063.1940	1015.8775	969.3348	877.8735	804.0003	776.0373	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.4017	34.5330	34.6652	35.3417	35.4802	36.1893	36.1893	36.3345	35.9023	35.4802	35.2043	34.9327	
alpha	3.2934	3.3022	3.3110	3.3561	3.3653	3.4126	3.4126	3.4223	3.3935	3.3653	3.3470	3.3288	
util living area													

	0.9378	0.9044	0.8566	0.7643	0.6391	0.4792	0.3535	0.3832	0.5708	0.7905	0.9037	0.9445	(86)
MIT	19.4310	19.7279	20.0835	20.5040	20.7861	20.9417	20.9842	20.9791	20.8907	20.5254	19.9350	19.3946	(87)
Th 2	20.2469	20.2495	20.2522	20.2655	20.2682	20.2815	20.2815	20.2842	20.2762	20.2682	20.2628	20.2575	(88)
util rest of house													
	0.9304	0.8937	0.8407	0.7393	0.6028	0.4316	0.2983	0.3268	0.5225	0.7627	0.8911	0.9378	(89)
MIT 2	18.3984	18.7702	19.2120	19.7297	20.0569	20.2333	20.2715	20.2703	20.1803	19.7666	19.0436	18.3601	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	18.7189	19.0675	19.4826	19.9700	20.2832	20.4532	20.4927	20.4903	20.4008	20.0021	19.3203	18.6812	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5689	18.9175	19.3326	19.8200	20.1332	20.3032	20.3427	20.3403	20.2508	19.8521	19.1703	18.5312	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9096	0.8707	0.8182	0.7229	0.5957	0.4330	0.3030	0.3313	0.5207	0.7452	0.8687	0.9181	(94)
Useful gains	738.3197	815.5067	831.6977	793.1589	673.7816	478.6847	322.2003	336.5719	504.7573	654.2220	698.4464	712.4656	(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													
	1308.3807	1280.4415	1167.7318	974.6710	749.7751	497.1173	326.2347	342.0879	540.4236	822.5817	1081.5438	1294.1201	(97)
Space heating kWh													
	424.1254	312.4362	250.0093	130.6887	56.5391	0.0000	0.0000	0.0000	0.0000	125.2596	275.8301	432.7509	(98a)
Space heating requirement - total per year (kWh/year)												2007.6393	
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													
	424.1254	312.4362	250.0093	130.6887	56.5391	0.0000	0.0000	0.0000	0.0000	125.2596	275.8301	432.7509	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2007.6393	
Space heating per m2											(98c) / (4) =	17.6791	(99)

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												89.5000	(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													
	424.1254	312.4362	250.0093	130.6887	56.5391	0.0000	0.0000	0.0000	0.0000	125.2596	275.8301	432.7509	(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)													
	473.8831	349.0907	279.3401	146.0209	63.1722	0.0000	0.0000	0.0000	0.0000	139.9548	308.1900	483.5206	(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													
	263.0684	232.6866	247.5547	218.7923	212.7879	192.5174	190.6966	197.9237	199.6816	221.6932	234.4860	260.3735	(64)
Efficiency of water heater												89.5000	(216)
(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	(217)
Fuel for water heating, kWh/month													
	293.9312	259.9850	276.5974	244.4606	237.7518	215.1032	213.0688	221.1438	223.1080	247.7019	261.9955	290.9201	(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	28.6041	25.8359	28.6041	27.6813	28.6041	27.6813	28.6041	28.6041	27.6813	28.6041	27.6813	28.6041	(231)
Lighting	35.6422	28.5935	25.7453	18.8621	14.5696	11.9035	13.2909	17.2760	22.4398	29.4423	33.2550	36.6328	(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												2243.1724	(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												2985.7674	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8540)													
mechanical ventilation fans (SFP = 0.8540)												295.7897	(230a)
central heating pump												41.0000	(230c)
Total electricity for the above, kWh/year												336.7897	(231)
Electricity for lighting (calculated in Appendix L)												287.6532	(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												5853.3827	(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	2243.1724	0.2100	471.0662	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2985.7674	0.2100	627.0111	(264)
Space and water heating			1098.0774	(265)
Pumps, fans and electric keep-hot	336.7897	0.1387	46.7169	(267)
Energy for lighting	287.6532	0.1443	41.5172	(268)
Total CO2, kg/year			1186.3115	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			10.4500	(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	2243.1724	1.1300	2534.7849	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2985.7674	1.1300	3373.9171	(278)
Space and water heating			5908.7020	(279)
Pumps, fans and electric keep-hot	336.7897	1.5128	509.4955	(281)
Energy for lighting	287.6532	1.5338	441.2120	(282)
Total Primary energy kWh/year			6859.4095	(286)
Dwelling Primary energy Rate (DPER)			60.4000	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.6600	(1b)	x 2.5000	(2b) =	149.1500	(1b) - (3b)
First floor	53.9000	(1c)	x 2.5000	(2c) =	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		283.9000	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3909	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3323	(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	0.4236	0.4153	0.4070	0.3655	0.3572	0.3156	0.3156	0.3073	0.3323	0.3572	0.3738	0.3904	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5699	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1300	7.7558			(28a)
External Wall	91.0000	19.2300	71.7700	0.1800	12.9186			(29a)
Basement Wall	48.7500		48.7500	0.1800	8.7750			(29a)
Corridor Wall	19.2500		19.2500	0.1800	3.4650			(29a)
Ceiling to corridor	5.7600		5.7600	0.1100	0.6336			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.2930			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.3000	0.0500	0.7150
E3 Sill	13.4000	0.0500	0.6700
E4 Jamb	27.6000	0.0500	1.3800
E5 Ground floor (normal)	34.2000	0.1600	5.4720
E6 Intermediate floor within a dwelling	29.4000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.7370 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 65.0300 (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	55.2502	54.9238	54.6038	53.1009	52.8197	51.5107	51.5107	51.2683	52.0149	52.8197	53.3885	53.9832	(38)
Heat transfer coeff	120.2802	119.9537	119.6338	118.1308	117.8496	116.5406	116.5406	116.2982	117.0448	117.8496	118.4185	119.0132	(39)

Average = Sum(39)m / 12 = 118.1295

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0592	1.0563	1.0535	1.0403	1.0378	1.0262	1.0262	1.0241	1.0307	1.0378	1.0428	1.0480	(40)
HLP (average)												1.0402	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

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4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8346 (42)

Hot water usage for mixer showers

71.7466	70.6684	69.0972	66.0910	63.8726	61.3986	59.9924	61.5516	63.2609	65.9172	68.9879	71.4717	(42a)

Hot water usage for baths

30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)

Hot water usage for other uses

43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)

Average daily hot water use (litres/day) 134.5581 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.3822	143.2563	139.4497	133.6615	128.9610	123.9076	121.9657	125.7559	129.7532	135.0583	140.9357	146.0026	(44)
Energy conte	231.8336	203.9951	214.3290	182.9759	173.6063	152.3589	147.5069	155.7120	159.9986	183.2729	200.7888	228.6047	(45)

Energy content (annual) Total = Sum(45)m = 2234.9826

Distribution loss (46)m = 0.15 x (45)m

34.7750	30.5993	32.1494	27.4464	26.0409	22.8538	22.1260	23.3568	23.9998	27.4909	30.1183	34.2907	(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)
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)
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)

Primary loss
Combi loss

Total heat required for water heating calculated for each month

278.4285	246.0808	260.9239	228.0677	220.2012	197.4507	194.1018	202.3069	205.0905	229.8678	245.8806	275.1996	(62)
-32.7995	-29.0082	-30.3757	-25.1523	-23.4410	-20.0586	-18.8018	-19.9938	-20.7534	-24.4660	-27.7170	-32.1921	(63a)
-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)

WWHRS
PV diverter
Solar input
FGHRS

Output from w/h

245.6290	217.0726	230.5482	202.9154	196.7602	177.3921	175.3000	182.3131	184.3370	205.4017	218.1636	243.0075	(64)

Total per year (kWh/year) = Sum(64)m = 2478.8405 (64)

12Total per year (kWh/year) 2479 (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

114.3606	101.4969	108.5403	96.9130	95.0000	86.7328	86.3220	89.0502	89.2730	98.2142	102.8357	113.2870	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	153.7105	151.0371	145.8875	134.6013	127.6882	120.4622	116.0242	119.6911	123.9903	132.0083	142.8274	152.2675	(72)
Total internal gains	645.7238	661.6618	633.5386	611.7531	580.5071	556.9119	535.3733	536.1702	552.5990	574.1163	609.2682	632.0776	(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	
East	10.1400	19.6403	0.6300	0.7000	0.7700	60.8635	(76)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739	(78)

Solar gains	163.7374	287.5429	410.6929	528.5295	603.2287	602.0139	579.2279	524.2038	452.2374	322.9995	197.8303	138.9437	(83)
Total gains	809.4612	949.2047	1044.2315	1140.2826	1183.7358	1158.9258	1114.6012	1060.3740	1004.8364	897.1158	807.0985	771.0213	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	26.2258	26.2972	26.3675	26.7030	26.7667	27.0673	27.0673	27.1238	26.9507	26.7667	26.6381	26.5050	
alpha	2.7484	2.7531	2.7578	2.7802	2.7844	2.8045	2.8045	2.8083	2.7967	2.7844	2.7759	2.7670	
util living area	0.9492	0.9227	0.8847	0.8121	0.7068	0.5616	0.4304	0.4650	0.6518	0.8378	0.9244	0.9548	(86)
MIT	18.7003	19.0411	19.4935	20.0604	20.5155	20.8218	20.9379	20.9213	20.7141	20.1143	19.3216	18.6484	(87)
Th 2	20.0343	20.0367	20.0390	20.0499	20.0520	20.0615	20.0615	20.0633	20.0578	20.0520	20.0478	20.0435	(88)
util rest of house	0.9422	0.9123	0.8689	0.7860	0.6647	0.4978	0.3483	0.3826	0.5921	0.8095	0.9125	0.9484	(89)
MIT 2	17.3462	17.7748	18.3408	19.0417	19.5787	19.9182	20.0249	20.0143	19.8117	19.1225	18.1410	17.2863	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	17.7665	18.1679	18.6986	19.3579	19.8695	20.1987	20.3083	20.2959	20.0918	19.4303	18.5074	17.7091	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7665	18.1679	18.6986	19.3579	19.8695	20.1987	20.3083	20.2959	20.0918	19.4303	18.5074	17.7091	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9197	0.8864	0.8421	0.7642	0.6559	0.5077	0.3706	0.4039	0.5944	0.7877	0.8876	0.9273	(94)
Useful gains	744.4570	841.3749	879.3491	871.3865	776.4084	588.3324	413.0870	428.2820	597.2691	706.6522	716.3496	714.9827	(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	1619.7562	1591.5306	1459.3650	1235.4045	962.7708	652.4731	432.1688	453.0826	701.3121	1040.6525	1350.8517	1607.7598	(97)
Space heating kWh	651.2226	504.1047	431.5319	262.0930	138.6536	0.0000	0.0000	0.0000	0.0000	248.4962	456.8415	664.2262	(98a)
Space heating requirement - total per year (kWh/year)												3357.1696	
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	651.2226	504.1047	431.5319	262.0930	138.6536	0.0000	0.0000	0.0000	0.0000	248.4962	456.8415	664.2262	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3357.1696	
Space heating per m2											(98c) / (4) =	29.5630	(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	651.2226	504.1047	431.5319	262.0930	138.6536	0.0000	0.0000	0.0000	0.0000	248.4962	456.8415	664.2262	(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)	705.5500	546.1589	467.5318	283.9577	150.2206	0.0000	0.0000	0.0000	0.0000	269.2266	494.9529	719.6383	(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	245.6290	217.0726	230.5482	202.9154	196.7602	177.3921	175.3000	182.3131	184.3370	205.4017	218.1636	243.0075	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1393	85.8845	85.4444	84.6347	83.2896	79.8000	79.8000	79.8000	79.8000	84.4880	85.6770	86.1961	(217)
Fuel for water heating, kWh/month	285.1533	252.7496	269.8226	239.7543	236.2363	222.2958	219.6742	228.4625	230.9988	243.1136	254.6351	281.9241	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	30.5270	24.4899	22.0504	16.1551	12.4787	10.1952	11.3835	14.7966	19.2194	25.2169	28.4824	31.3754	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-29.6106	-43.4327	-64.9074	-75.9429	-84.4306	-79.6887	-78.6785	-73.0085	-63.4610	-50.9440	-33.1360	-25.4044	(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	-11.9580	-25.5846	-51.6730	-78.8402	-105.4799	-106.4739	-105.2572	-88.5812	-64.1971	-37.0274	-16.1024	-9.4268	(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 3637.2369 (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 2964.8202 (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) 246.3704 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV generation	-1403.2469	(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	5531.1806	(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	3637.2369	0.2100	763.8197	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2964.8202	0.2100	622.6122	(264)
Space and water heating			1386.4320	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	246.3704	0.1443	35.5589	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	0.1338	-93.9992	
PV Unit electricity exported	-700.6017	0.1254	-87.8749	
Total			-181.8741	(269)
Total CO2, kg/year			1252.0460	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0300	(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	3637.2369	1.1300	4110.0777	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2964.8202	1.1300	3350.2468	(278)
Space and water heating			7460.3245	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	246.3704	1.5338	377.8912	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	1.4944	-1050.0185	
PV Unit electricity exported	-700.6017	0.4604	-322.5449	
Total			-1372.5634	(283)
Total Primary energy kWh/year			6595.7531	(286)
Target Primary Energy Rate (TPER)			58.0800	(287)

12 Appendix 2 – Be Green SAP Worksheets

Full SAP Calculation Printout

Property Reference	11577 1	**Issued on Date**	25/07/2024
Assessment Reference	Be Green - V4	**Prop Type Ref**	Flat 1
Property	Corner of, Maryland Road & High Road, London, N22		

SAP Rating	93 A	**DER**	0.86	**TER**	11.06
Environmental	99 A	**% DER < TER**			92.22
CO_2 Emissions (t/year)	0.06	**DFEE**	34.62	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			1.71
% DPER < TPER	71.85	**DPER**	16.41	**TPER**	58.29

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.6600 (1b)	x	2.5000 (2b)	=	149.1500	(1b) - (3b)
First floor	53.9000 (1c)	x	2.5000 (2c)	=	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	113.5600					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	283.9000	(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		3.5000	(17)
Infiltration rate		0.1750	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1487	(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	0.1897	0.1859	0.1822	0.1636	0.1599	0.1413	0.1413	0.1376	0.1487	0.1599	0.1673	0.1748	(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) =		80.1000 (23c)

Effective ac	0.2892	0.2854	0.2817	0.2631	0.2594	0.2408	0.2408	0.2371	0.2482	0.2594	0.2668	0.2743	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Door			1.8900	1.4000	2.6460			(26)
Window (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1100	6.5626			(28a)
External Wall	91.0000	19.2300	71.7700	0.1700	12.2009			(29a)
Basement Wall	48.7500		48.7500	0.1700	8.2875			(29a)
Corridor Wall	19.2500		19.2500	0.1700	3.2725			(29a)
Ceiling to corridor	5.7600		5.7600	0.0970	0.5587			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.3831			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	100.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	11.2210	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	64.6041	(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	27.0902	26.7418	26.3934	24.6514	24.3030	22.5610	22.5610	22.2126	23.2578	24.3030	24.9998	25.6966	(38)
Heat transfer coeff	91.6943	91.3459	90.9975	89.2555	88.9071	87.1651	87.1651	86.8167	87.8619	88.9071	89.6039	90.3007	(39)
Average = Sum(39)m / 12 =												89.1684	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8075	0.8044	0.8013	0.7860	0.7829	0.7676	0.7676	0.7645	0.7737	0.7829	0.7890	0.7952	(40)
HLP (average)												0.7852	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8346 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	89.6832	88.3354	86.3715	82.6138	79.8407	76.7482	74.9905	76.9395	79.0761	82.3965	86.2349	89.3396	(42a)
Hot water usage for baths	30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)
Hot water usage for other uses	43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)
Average daily hot water use (litres/day)												151.0951	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	164.3188	160.9234	156.7240	150.1842	144.9291	139.2572	136.9638	141.1438	145.5684	151.5376	158.1827	163.8705	(44)
Energy conte	260.2408	229.1528	240.8790	205.5947	195.1025	171.2330	165.6458	174.7655	179.5004	205.6351	225.3603	256.5816	(45)
Energy content (annual)										Total = Sum(45)m =		2509.6914	
Distribution loss (46)m = 0.15 x (45)m	39.0361	34.3729	36.1318	30.8392	29.2654	25.6850	24.8469	26.2148	26.9251	30.8453	33.8040	38.4872	(46)
Water storage loss:													
Store volume												170.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2300	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.6642	(55)
Total storage loss	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(56)
If cylinder contains dedicated solar storage	20.5902	18.5976	20.5902	19.9260	20.5902	19.9260	20.5902	20.5902	19.9260	20.5902	19.9260	20.5902	(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	304.0934	268.7616	284.7316	248.0327	238.9551	213.6710	209.4984	218.6181	221.9384	249.4877	267.7983	300.4342	(62)
WWHRS	-52.0734	-46.0542	-48.2253	-39.9324	-37.2156	-31.8457	-29.8502	-31.7427	-32.9487	-38.8429	-44.0043	-51.1091	(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	252.0200	222.7074	236.5063	208.1003	201.7395	181.8254	179.6482	186.8753	188.9896	210.6448	223.7940	249.3251	(64)
										Total per year (kWh/year) = Sum(64)m =		2542.1758	(64)
12Total per year (kWh/year)												2542	(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	121.6122	107.8803	115.1743	102.3106	99.9537	90.8854	90.1593	93.1916	93.6343	103.4558	108.8827	120.3955	(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	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	163.4572	160.5362	154.8042	142.0981	134.3463	126.2297	121.1819	125.2575	130.0476	139.0534	151.2260	161.8218	(72)
Total internal gains	652.4705	668.1609	639.4553	616.2498	584.1652	562.6794	540.5310	541.7367	558.6563	578.1615	614.6668	638.6320	(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	
East	10.1400	19.6403	0.3500	0.0000	0.7700	53.6715	(76)
South	7.2000	46.7521	0.3500	0.0000	0.7700	90.7177	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	144.3892	253.5651	362.1630	466.0754	531.9477	530.8765	510.7830	462.2609	398.7984	284.8320	174.4535	122.5253	(83)
Total gains	796.8598	921.7261	1001.6183	1082.3253	1116.1129	1093.5558	1051.3140	1003.9975	957.4548	862.9935	789.1203	761.1573	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	34.4017	34.5330	34.6652	35.3417	35.4802	36.1893	36.1893	36.3345	35.9023	35.4802	35.2043	34.9327	
alpha	3.2934	3.3022	3.3110	3.3561	3.3653	3.4126	3.4126	3.4223	3.3935	3.3653	3.3470	3.3288	
util living area													

	0.9406	0.9079	0.8609	0.7696	0.6450	0.4836	0.3573	0.3874	0.5763	0.7968	0.9078	0.9472	(86)
Living	19.7119	19.9370	20.2067	20.5276	20.7435	20.8648	20.8975	20.8938	20.8249	20.5428	20.0935	19.6851	
Non living	18.7183	19.0011	19.3372	19.7360	19.9876	20.1285	20.1580	20.1580	20.0856	19.7635	19.2111	18.6927	
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	20.3411	19.9370	20.2067	20.5276	20.7435	20.8648	20.8975	20.8938	20.8249	20.5428	20.0935	19.8690	(87)
Th 2	20.2469	20.2495	20.2522	20.2655	20.2682	20.2815	20.2815	20.2842	20.2762	20.2682	20.2628	20.2575	(88)
util rest of house													
	0.9335	0.8974	0.8452	0.7449	0.6087	0.4357	0.3015	0.3305	0.5278	0.7694	0.8956	0.9408	(89)
MIT 2	19.6375	19.0011	19.3372	19.7360	19.9876	20.1285	20.1580	20.1580	20.0856	19.7635	19.2111	18.9747	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	19.8559	19.2916	19.6071	19.9817	20.2222	20.3570	20.3875	20.3864	20.3151	20.0054	19.4850	19.2523	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.8559	19.2916	19.6071	19.9817	20.2222	20.3570	20.3875	20.3864	20.3151	20.0054	19.4850	19.2523	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9293	0.8818	0.8301	0.7346	0.6063	0.4409	0.3099	0.3388	0.5305	0.7586	0.8806	0.9305	(94)
Useful gains	740.5478	812.7914	831.4321	795.0747	676.6711	482.1552	325.7667	340.1083	507.9376	654.6862	694.8879	708.2545	(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													
	1426.3859	1314.6158	1192.7150	989.1056	757.6869	501.8134	330.1417	346.0865	546.0716	836.2088	1109.7470	1359.2339	(97)
Space heating kWh													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98a)
Space heating requirement - total per year (kWh/year)												2234.3421	
Solar heating kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)												0.0000	
Space heating kWh													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												2234.3421	
Space heating per m2											(98c) / (4) =	19.6754	(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 %)	354.8982	(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													
	510.2636	337.2260	268.7945	139.7022	60.2758	0.0000	0.0000	0.0000	0.0000	135.0528	298.6986	484.3287	(98)
Space heating efficiency (main heating system 1)													
	354.8982	354.8982	354.8982	354.8982	354.8982	0.0000	0.0000	0.0000	0.0000	354.8982	354.8982	354.8982	(210)
Space heating fuel (main heating system)													
	143.7774	95.0205	75.7385	39.3640	16.9840	0.0000	0.0000	0.0000	0.0000	38.0540	84.1646	136.4698	(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													
	252.0200	222.7074	236.5063	208.1003	201.7395	181.8254	179.6482	186.8753	188.9896	210.6448	223.7940	249.3251	(64)
Efficiency of water heater												190.4310	(216)
(217)m	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	190.4310	(217)
Fuel for water heating, kWh/month													
	132.3419	116.9491	124.1952	109.2785	105.9383	95.4810	94.3377	98.1328	99.2431	110.6147	117.5197	130.9267	(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	25.1219	22.6907	25.1219	24.3115	25.1219	24.3115	25.1219	25.1219	24.3115	25.1219	24.3115	25.1219	(231)
Lighting	35.6422	28.5935	25.7453	18.8621	14.5696	11.9035	13.2909	17.2760	22.4398	29.4423	33.2550	36.6328	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-44.9360	-66.1122	-99.0216	-114.6579	-126.0807	-117.3215	-115.9121	-107.8858	-93.4006	-76.3885	-50.0201	-38.4297	(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	-15.9191	-35.4375	-73.9291	-117.1301	-160.2739	-164.2106	-161.8995	-134.8396	-96.7021	-53.4292	-22.1628	-12.4956	(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	629.5726	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	190.4310	
Water heating fuel used	1334.9588	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.4000, SFP = 0.8540)		
mechanical ventilation fans (SFP = 0.8540)	295.7897	(230a)
Total electricity for the above, kWh/year	295.7897	(231)
Electricity for lighting (calculated in Appendix L)	287.6532	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-2098.5959	(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	449.3784	(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	629.5726	0.1560	98.2267	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1334.9588	0.1409	188.0540	(264)
Space and water heating			286.2807	(265)
Pumps, fans and electric keep-hot	295.7897	0.1387	41.0297	(267)
Energy for lighting	287.6532	0.1443	41.5172	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1050.1668	0.1340	-140.7204	
PV Unit electricity exported	-1048.4291	0.1244	-130.4459	
Total			-271.1663	(269)
Total CO2, kg/year			97.6614	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			0.8600	(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	629.5726	1.5776	993.1981	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1334.9588	1.5209	2030.3120	(278)
Space and water heating			3023.5101	(279)
Pumps, fans and electric keep-hot	295.7897	1.5128	447.4707	(281)
Energy for lighting	287.6532	1.5338	441.2120	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1050.1668	1.4952	-1570.2161	
PV Unit electricity exported	-1048.4291	0.4566	-478.7537	
Total			-2048.9698	(283)
Total Primary energy kWh/year			1863.2230	(286)
Dwelling Primary energy Rate (DPER)			16.4100	(287)

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

1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	59.6600 (1b)	x	2.5000 (2b)	=	149.1500	(1b) - (3b)
First floor	53.9000 (1c)	x	2.5000 (2c)	=	134.7500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 113.5600						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	283.9000	(5)

2. Ventilation rate

	m3 per hour		
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	4 * 10 =	40.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1409	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.3909	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3323	(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	0.4236	0.4153	0.4070	0.3655	0.3572	0.3156	0.3156	0.3073	0.3323	0.3572	0.3738	0.3904	(22b)
Effective ac	0.5897	0.5862	0.5828	0.5668	0.5638	0.5498	0.5498	0.5472	0.5552	0.5638	0.5699	0.5762	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.20)			17.3400	1.1450	19.8550			(27)
Heat Loss Floor 1			59.6600	0.1300	7.7558			(28a)
External Wall	91.0000	19.2300	71.7700	0.1800	12.9186			(29a)
Basement Wall	48.7500		48.7500	0.1800	8.7750			(29a)
Corridor Wall	19.2500		19.2500	0.1800	3.4650			(29a)
Ceiling to corridor	5.7600		5.7600	0.1100	0.6336			(30)
Total net area of external elements Aum(A, m2)			224.4200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.2930			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 100.0000 (35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	14.3000	0.0500	0.7150
E3 Sill	13.4000	0.0500	0.6700
E4 Jamb	27.6000	0.0500	1.3800
E5 Ground floor (normal)	34.2000	0.1600	5.4720
E6 Intermediate floor within a dwelling	29.4000	0.0000	0.0000
E16 Corner (normal)	10.0000	0.0900	0.9000
E18 Party wall between dwellings	10.0000	0.0600	0.6000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.7370 (36)
Point Thermal bridges (36a) = 0.0000
Total fabric heat loss (33) + (36) + (36a) = 65.0300 (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	55.2502	54.9238	54.6038	53.1009	52.8197	51.5107	51.5107	51.2683	52.0149	52.8197	53.3885	53.9832	(38)
Heat transfer coeff	120.2802	119.9537	119.6338	118.1308	117.8496	116.5406	116.5406	116.2982	117.0448	117.8496	118.4185	119.0132	(39)
Average = Sum(39)m / 12 =												118.1295	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0592	1.0563	1.0535	1.0403	1.0378	1.0262	1.0262	1.0241	1.0307	1.0378	1.0428	1.0480	(40)
HLP (average)												1.0402	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8346 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	71.7466	70.6684	69.0972	66.0910	63.8726	61.3986	59.9924	61.5516	63.2609	65.9172	68.9879	71.4717	(42a)
Hot water usage for baths	30.9766	30.5165	29.8687	28.6742	27.7798	26.7880	26.2523	26.8956	27.5960	28.6573	29.8764	30.8719	(42b)
Hot water usage for other uses	43.6590	42.0714	40.4838	38.8962	37.3086	35.7210	35.7210	37.3086	38.8962	40.4838	42.0714	43.6590	(42c)
Average daily hot water use (litres/day)												134.5581	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	146.3822	143.2563	139.4497	133.6615	128.9610	123.9076	121.9657	125.7559	129.7532	135.0583	140.9357	146.0026	(44)
Energy conte	231.8336	203.9951	214.3290	182.9759	173.6063	152.3589	147.5069	155.7120	159.9986	183.2729	200.7888	228.6047	(45)
Energy content (annual)										Total = Sum(45)m =		2234.9826	
Distribution loss (46)m = 0.15 x (45)m	34.7750	30.5993	32.1494	27.4464	26.0409	22.8538	22.1260	23.3568	23.9998	27.4909	30.1183	34.2907	(46)

Water storage loss:
Store volume 170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5003 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8102 (55)
Total storage loss

	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153	(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	280.2113	247.6911	262.7067	229.7930	221.9840	199.1760	195.8846	204.0897	206.8157	231.6506	247.6059	276.9824	(62)
WWHRS	-32.7995	-29.0082	-30.3757	-25.1523	-23.4410	-20.0586	-18.8018	-19.9938	-20.7534	-24.4660	-27.7170	-32.1921	(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	247.4118	218.6829	232.3310	204.6407	198.5430	179.1173	177.0828	184.0959	186.0623	207.1845	219.8889	244.7903	(64)
										Total per year (kWh/year) = Sum(64)m =		2499.8315	(64)
12Total per year (kWh/year)												2500	(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

	115.7868	102.7852	109.9666	98.2932	96.4262	88.1130	87.7482	90.4764	90.6532	99.6404	104.2160	114.7132	(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	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	141.7295	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	146.9197	162.6611	146.9197	151.8170	146.9197	151.8170	146.9197	146.9197	151.8170	146.9197	151.8170	146.9197	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	276.5748	279.4448	272.2125	256.8159	237.3804	219.1138	206.9106	204.0406	211.2729	226.6695	246.1050	264.3716	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	37.1729	(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)	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	-113.3836	(71)
Water heating gains (Table 5)	155.6275	152.9541	147.8045	136.5183	129.6052	122.3792	117.9411	121.6081	125.9073	133.9253	144.7444	154.1845	(72)
Total internal gains	647.6408	663.5788	635.4556	613.6700	582.4241	558.8289	537.2903	538.0872	554.5160	576.0333	611.1852	633.9946	(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	
East	10.1400	19.6403	0.6300	0.7000	0.7700	60.8635	(76)
South	7.2000	46.7521	0.6300	0.7000	0.7700	102.8739	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	163.7374	287.5429	410.6929	528.5295	603.2287	602.0139	579.2279	524.2038	452.2374	322.9995	197.8303	138.9437	(83)
Total gains	811.3782	951.1217	1046.1484	1142.1996	1185.6528	1160.8428	1116.5182	1062.2910	1006.7534	899.0328	809.0155	772.9383	(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	26.2258	26.2972	26.3675	26.7030	26.7667	27.0673	27.0673	27.1238	26.9507	26.7667	26.6381	26.5050	
alpha	2.7484	2.7531	2.7578	2.7802	2.7844	2.8045	2.8045	2.8083	2.7967	2.7844	2.7759	2.7670	
util living area	0.9489	0.9224	0.8843	0.8116	0.7062	0.5609	0.4297	0.4643	0.6511	0.8372	0.9240	0.9545	(86)
MIT	18.7033	19.0438	19.4959	20.0622	20.5167	20.8223	20.9381	20.9216	20.7150	20.1163	19.3243	18.6515	(87)
Th 2	20.0343	20.0367	20.0390	20.0499	20.0520	20.0615	20.0615	20.0633	20.0578	20.0520	20.0478	20.0435	(88)
util rest of house	0.9419	0.9119	0.8685	0.7854	0.6641	0.4972	0.3477	0.3820	0.5913	0.8088	0.9121	0.9482	(89)
MIT 2	17.3499	17.7781	18.3436	19.0438	19.5799	19.9187	20.0251	20.0145	19.8125	19.1248	18.1443	17.2901	(90)
Living area fraction									fLA = Living area / (4) =			0.3104	(91)
MIT	17.7700	18.1710	18.7013	19.3599	19.8707	20.1992	20.3085	20.2961	20.0927	19.4325	18.5106	17.7127	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7700	18.1710	18.7013	19.3599	19.8707	20.1992	20.3085	20.2961	20.0927	19.4325	18.5106	17.7127	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9193	0.8860	0.8417	0.7637	0.6553	0.5070	0.3701	0.4033	0.5937	0.7871	0.8871	0.9270	(94)
Useful gains	745.9382	842.7072	880.5010	872.2582	776.9663	588.5852	413.1787	428.4032	597.6821	707.6017	717.6844	716.4984	(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	1620.1762	1591.9091	1459.6896	1235.6405	962.9124	652.5314	432.1888	453.1094	701.4124	1040.9115	1351.2274	1608.1857	(97)
Space heating kWh	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(98a)
Space heating requirement - total per year (kWh/year)												3352.3410	
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	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3352.3410	
Space heating per m2										(98c) / (4) =		29.5204	(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	650.4331	503.4637	430.9163	261.6353	138.3439	0.0000	0.0000	0.0000	0.0000	247.9825	456.1509	663.4154	(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)	704.6946	545.4644	466.8649	283.4618	149.8850	0.0000	0.0000	0.0000	0.0000	268.6701	494.2047	718.7599	(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	247.4118	218.6829	232.3310	204.6407	198.5430	179.1173	177.0828	184.0959	186.0623	207.1845	219.8889	244.7903	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1234	85.8674	85.4251	84.6119	83.2655	79.8000	79.8000	79.8000	79.8000	84.4639	85.6578	86.1803	(217)
Fuel for water heating, kWh/month	287.2758	254.6752	271.9704	241.8582	238.4455	224.4578	221.9083	230.6966	233.1608	245.2936	256.7063	284.0445	(219)
Space cooling fuel requirement													
(221)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(221)
Pumps and Fa	7.3041	6.5973	7.3041	7.0685	7.3041	7.0685	7.3041	7.3041	7.0685	7.3041	7.0685	7.3041	(231)
Lighting	30.5270	24.4899	22.0504	16.1551	12.4787	10.1952	11.3835	14.7966	19.2194	25.2169	28.4824	31.3754	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-29.6106	-43.4327	-64.9074	-75.9429	-84.4306	-79.6887	-78.6785	-73.0085	-63.4610	-50.9440	-33.1360	-25.4044	(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	-11.9580	-25.5846	-51.6730	-78.8402	-105.4799	-106.4739	-105.2572	-88.5812	-64.1971	-37.0274	-16.1024	-9.4268	(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	(235d)

Annual totals kWh/year		
Space heating fuel - main system 1	3632.0055	(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	2990.4930	(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)	246.3704	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-1403.2469	(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	5551.6220	(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	3632.0055	0.2100	762.7211	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2990.4930	0.2100	628.0035	(264)
Space and water heating			1390.7247	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	246.3704	0.1443	35.5589	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	0.1338	-93.9992	
PV Unit electricity exported	-700.6017	0.1254	-87.8749	
Total			-181.8741	(269)
Total CO2, kg/year			1256.3387	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.0600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3632.0055	1.1300	4104.1662	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2990.4930	1.1300	3379.2571	(278)
Space and water heating			7483.4233	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	246.3704	1.5338	377.8912	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-702.6452	1.4944	-1050.0185	
PV Unit electricity exported	-700.6017	0.4604	-322.5449	
Total			-1372.5634	(283)
Total Primary energy kWh/year			6618.8519	(286)
Target Primary Energy Rate (TPER)			58.2900	(287)

13 Appendix 3 – Solar PV Roof Plan