BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

Corner of Maryland Road and High Road
London
N22 5AR

Job number: 11577

Date: December 2023

BASE ENERGY LIVERPOOL
Head Office
T: +44 (0)151 933 0328
E: north@baseenergy.co.uk

BASE ENERGY LONDON
London Office
T: +44 (0)203 286 2016
E: south@baseenergy.co.uk

BASE ENERGY SHEFFIELD
Sheffield Office
T: +44 (0)114 303 4986
E: north@baseenergy.co.uk

Revision	Issue Date	Author	Checked	Description
0	19/12/2023	ROB	PK	First 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 4
- A design which limits thermal bridging by targeting the notional Y-value 0.05.
- Energy saving building services including low energy lighting and heating controls.
- Low carbon Air Source Heat Pumps with a 290% efficiency in winter and 175% efficiency in summer.

- 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.

This results in an 89% CO2 reduction Part L1 2021. With a total of 69% CO2 reduction through energy saving measures and 20% from the installation of on-site renewable energy

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 2021

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

Local Planning Policy

The Haringey Local Planning Policy requirements are as follows.

The development should target:

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

4 Methodology

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

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

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

- Materials used for the construction and the thermal insulation of the building fabric (u-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	13.45	405	5,447

The **Total Baseline CO2 Emissions** for the development are shown to be 5,447 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
Doors	1.6	1.0	1.4
Air permeability	8.00	5.00	4

- 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: Air Source Heat Pump.
- Heating Controls: Time and temperature zone control
- Ventilation: Natural extract fans

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)	Reduction in CO2
Baseline	13.45	405	5,447	N/A
Be Lean	4.23	405	1,713	**69%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 3,734 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)

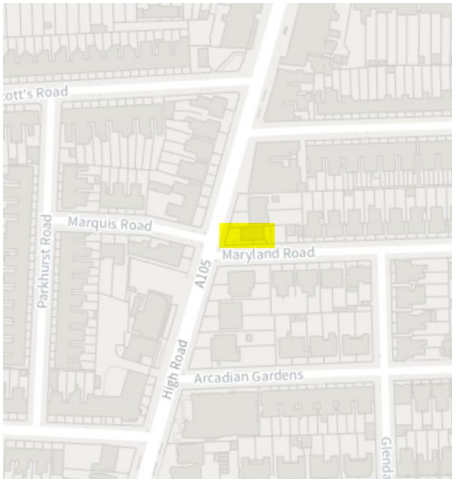
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating 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 a 290% efficiency in winter and 175% efficiency in summer.

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.

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

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The 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	13.45	405	5,447	N/A
Lean & Green Design	1.5	405	622	**89%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 4,4825 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 82% 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	3.7	69%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	1.1	20%
Cumulative on site savings	**4.8**	**89%**
Annual savings from off-set payment	0.6	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**19**	-
Cash in-lieu contribution (£)	**1,772**	

*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 (290% efficiency in winter and 175% efficiency in summer) with solar PV, 2.4kWp for each flat, totalling 14.4kWp for the total development.

This results in an 89% CO2 reduction Part L1 2021. With a total of 69% CO2 reduction through energy saving measures and 20% from the installation of on-site renewable energy

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 – Baseline/Be Lean SAP Worksheets

Full SAP Calculation Printout

Property Reference	11577 1	**Issued on Date**	03/01/2024
Assessment Reference	Be Lean	**Prop Type Ref**	Flat 1
Property	Corner of, Maryland Road & High Road, London, N22		

SAP Rating	78 C	**DER**	4.80	**TER**	11.12
Environmental	95 A	**% DER < TER**			56.83
CO_2 Emissions (t/year)	0.5	**DFEE**	33.11	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			6.00
% DPER < TPER	13.69	**DPER**	50.56	**TPER**	58.58

Assessor Details	Mr. Peter Kinsella	**Assessor ID**	L770-0002
Client			

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

---

1. Overall dwelling characteristics

	Area (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		4.0000	(17)
Infiltration rate		0.3409	(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) =	0.2898	(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	0.3694	0.3622	0.3550	0.3187	0.3115	0.2753	0.2753	0.2680	0.2898	0.3115	0.3260	0.3405	(22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5580	(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	53.2371	52.9889	52.7455	51.6025	51.3886	50.3931	50.3931	50.2087	50.7765	51.3886	51.8212	52.2735	(38)

Heat transfer coeff

	117.8413	117.5930	117.3497	116.2066	115.9928	114.9972	114.9972	114.8128	115.3807	115.9928	116.4254	116.8777 (39)
Average = Sum(39)m / 12 =												116.2056

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0355	1.0334	1.0233	1.0214	1.0127	1.0127	1.0110	1.0160	1.0214	1.0252	1.0292	(40)
HLP (average)												1.0233	
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)
Hot water usage for mixer showers												
	98.6515	97.1690	95.0086	90.8752	87.8248	84.4231	82.4895	84.6335	86.9837	90.6362	94.8584	98.2735 (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)												159.3636 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	173.2871	169.7570	165.3612	158.4456	152.9132	146.9321	144.4628	148.8377	153.4760	159.7773	166.8062	172.8044	(44)
Energy conte	274.4445	241.7316	254.1539	216.9041	205.8506	180.6701	174.7152	184.2922	189.2512	216.8163	237.6460	270.5700	(45)
Energy content (annual)										Total = Sum(45)m =		2647.0458	
Distribution loss (46)m = 0.15 x (45)m													
	41.1667	36.2597	38.1231	32.5356	30.8776	27.1005	26.2073	27.6438	28.3877	32.5224	35.6469	40.5855	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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													
	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(64)
										Total per year (kWh/year) = Sum(64)m =		3236.3018	(64)
12Total per year (kWh/year)												3236	(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													
	131.2899	116.5383	124.5433	110.8662	108.4824	98.8184	98.1299	101.3143	101.6716	112.1285	117.7629	130.0016	(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	17.0340	17.0340	17.0340	17.0340	17.0340	0.0000	0.0000	0.0000	0.0000	17.0340	17.0340	17.0340	(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)													
	176.4649	173.4201	167.3969	153.9809	145.8097	137.2478	131.8951	136.1751	141.2106	150.7104	163.5596	174.7334	(72)
Total internal gains													
	682.5122	698.0788	669.0820	645.1666	612.6627	573.6975	551.2442	552.6542	569.8193	606.8524	644.0344	668.5775	(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	0.5000	0.0000	0.7700	76.6736	(76)
South	7.2000	46.7521	0.5000	0.0000	0.7700	129.5967	(78)

Solar gains	206.2703	362.2359	517.3758	665.8220	759.9252	758.3949	729.6900	660.3727	569.7120	406.9029	249.2193	175.0362	(83)
Total gains	888.7826	1060.3147	1186.4577	1310.9886	1372.5879	1332.0924	1280.9342	1213.0269	1139.5314	1013.7553	893.2537	843.6137	(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	26.7686	26.8251	26.8807	27.1451	27.1952	27.4306	27.4306	27.4747	27.3395	27.1952	27.0941	26.9893	
alpha	2.7846	2.7883	2.7920	2.8097	2.8130	2.8287	2.8287	2.8316	2.8226	2.8130	2.8063	2.7993	
util living area													
	0.9369	0.9017	0.8516	0.7628	0.6437	0.5010	0.3772	0.4110	0.5961	0.7981	0.9056	0.9442	(86)
MIT	19.2991	19.5758	19.9201	20.3188	20.6159	20.7946	20.8594	20.8499	20.7263	20.3311	19.7515	19.2501	(87)
Th 2	20.0520	20.0538	20.0556	20.0640	20.0655	20.0728	20.0728	20.0741	20.0700	20.0655	20.0624	20.0591	(88)
util rest of house													

	0.9286	0.8893	0.8330	0.7336	0.6005	0.4408	0.3037	0.3362	0.5369	0.7664	0.8916	0.9367	(89)
MIT 2	18.0570	18.4028	18.8297	19.3174	19.6613	19.8571	19.9150	19.9096	19.7910	19.3451	18.6348	18.0005	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	18.4425	18.7669	19.1682	19.6283	19.9576	20.1481	20.2082	20.2015	20.0813	19.6511	18.9814	18.3884	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4425	18.7669	19.1682	19.6283	19.9576	20.1481	20.2082	20.2015	20.0813	19.6511	18.9814	18.3884	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9107	0.8690	0.8129	0.7187	0.5951	0.4459	0.3148	0.3468	0.5376	0.7505	0.8719	0.9198	(94)
Useful gains	809.3908	921.4352	964.4279	942.2042	816.8803	593.9537	403.2063	420.6875	612.6541	760.8343	778.8658	775.9300	(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	1666.5738	1630.6509	1486.6074	1246.6950	957.8244	638.0191	414.9283	436.4619	690.1274	1049.8661	1383.2984	1658.3052	(97)
Space heating kWh	637.7441	476.5930	388.5016	219.2334	104.8624	0.0000	0.0000	0.0000	0.0000	215.0397	435.1914	656.4872	(98a)
Space heating requirement - total per year (kWh/year)												3133.6527	
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	637.7441	476.5930	388.5016	219.2334	104.8624	0.0000	0.0000	0.0000	0.0000	215.0397	435.1914	656.4872	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3133.6527	
Space heating per m2											(98c) / (4) =	27.5947	(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 %)												230.0000	(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	637.7441	476.5930	388.5016	219.2334	104.8624	0.0000	0.0000	0.0000	0.0000	215.0397	435.1914	656.4872	(98)
Space heating efficiency (main heating system 1)	230.0000	230.0000	230.0000	230.0000	230.0000	0.0000	0.0000	0.0000	0.0000	230.0000	230.0000	230.0000	(210)
Space heating fuel (main heating system)	277.2800	207.2143	168.9137	95.3189	45.5924	0.0000	0.0000	0.0000	0.0000	93.4955	189.2137	285.4292	(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	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(64)
Efficiency of water heater												170.0000	(216)
(217)m	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	170.0000	(217)
Fuel for water heating, kWh/month	190.8770	168.7852	178.9414	156.0801	150.5276	134.7660	132.2127	137.8462	139.8137	156.9780	168.2812	188.5979	(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	14.4672	13.0672	14.4672	14.0005	14.4672	14.0005	14.4672	14.4672	14.0005	14.4672	14.0005	14.4672	(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	1362.4577	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	170.0000	
Water heating fuel used	1903.7070	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
warm air heating system fans	170.3400	(230b)
Total electricity for the above, kWh/year	170.3400	(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	3724.1578	(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	1362.4577	0.1553	211.6551	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1903.7070	0.1411	268.5302	(264)
Space and water heating			480.1853	(265)
Pumps, fans and electric keep-hot	170.3400	0.1387	23.6283	(267)
Energy for lighting	287.6532	0.1443	41.5172	(268)
Total CO2, kg/year			545.3308	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			4.8000	(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	1362.4577	1.5751	2146.0260	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1903.7070	1.5216	2896.6494	(278)
Space and water heating			5042.6755	(279)
Pumps, fans and electric keep-hot	170.3400	1.5128	257.6904	(281)
Energy for lighting	287.6532	1.5338	441.2120	(282)
Total Primary energy kWh/year			5741.5778	(286)
Dwelling Primary energy Rate (DPER)			50.5600	(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)
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												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	282.7597	249.9928	265.2551	232.2592	224.5323	201.6421	198.4330	206.6381	209.2819	234.1989	250.0721	279.5308	(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	249.9601	220.9847	234.8794	207.1069	201.0913	181.5835	179.6312	186.6443	188.5285	209.7329	222.3551	247.3387	(64)
										Total per year (kWh/year) = Sum(64)m =		2529.8365	(64)
12Total per year (kWh/year)												2530	(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	117.8255	104.6266	112.0053	100.2661	98.4649	90.0860	89.7869	92.5151	92.6262	101.6791	106.1889	116.7519	(65)

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)	158.3676	155.6943	150.5447	139.2585	132.3454	125.1194	120.6813	124.3483	128.6475	136.6654	147.4846	156.9246	(72)
Total internal gains	650.3810	666.3190	638.1957	616.4102	585.1643	561.5690	540.0304	540.8274	557.2562	578.7735	613.9254	636.7347	(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)

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	814.1184	953.8619	1048.8886	1144.9397	1188.3930	1163.5830	1119.2584	1065.0312	1009.4936	901.7730	811.7557	775.6784	(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	0.9486	0.9219	0.8837	0.8109	0.7053	0.5600	0.4288	0.4633	0.6500	0.8363	0.9235	0.9541	(86)
MIT	18.7076	19.0477	19.4993	20.0648	20.5183	20.8231	20.9384	20.9220	20.7163	20.1191	19.3282	18.6558	(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	0.9414	0.9114	0.8679	0.7846	0.6632	0.4963	0.3470	0.3811	0.5902	0.8079	0.9114	0.9478	(89)
MIT 2	17.3552	17.7829	18.3477	19.0468	19.5816	19.9194	20.0253	20.0148	19.8137	19.1280	18.1491	17.2955	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	17.7750	18.1755	18.7052	19.3628	19.8724	20.1999	20.3087	20.2964	20.0939	19.4357	18.5151	17.7178	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7750	18.1755	18.7052	19.3628	19.8724	20.1999	20.3087	20.2964	20.0939	19.4357	18.5151	17.7178	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9188	0.8855	0.8410	0.7629	0.6545	0.5061	0.3693	0.4024	0.5926	0.7862	0.8865	0.9265	(94)
Useful gains	748.0526	844.6088	882.1447	873.5012	777.7610	588.9447	413.3090	428.5754	598.2697	708.9552	719.5890	718.6622	(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	1620.7758	1592.4493	1460.1527	1235.9769	963.1140	652.6144	432.2173	453.1473	701.5550	1041.2807	1351.7634	1608.7938	(97)
Space heating kWh	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(98a)
Space heating requirement - total per year (kWh/year)												3345.4515	
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	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3345.4515	
Space heating per m2											(98c) / (4) =	29.4598	(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	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(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)	703.4735	544.4733	465.9133	282.7546	149.4069	0.0000	0.0000	0.0000	0.0000	267.8767	493.1371	717.5058	(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	249.9601	220.9847	234.8794	207.1069	201.0913	181.5835	179.6312	186.6443	188.5285	209.7329	222.3551	247.3387	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1008	85.8430	85.3978	84.5794	83.2316	79.8000	79.8000	79.8000	79.8000	84.4298	85.6305	86.1577	(217)
Fuel for water heating, kWh/month	290.3109	257.4288	275.0416	244.8667	241.6045	227.5483	225.1018	233.8901	236.2512	248.4110	259.6681	287.0766	(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	3624.5411	(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	3027.1996	(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	5580.8643	(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	3624.5411	0.2100	761.1536	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3027.1996	0.2100	635.7119	(264)
Space and water heating			1396.8656	(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			1262.4796	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1200	(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	3624.5411	1.1300	4095.7315	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3027.1996	1.1300	3420.7355	(278)
Space and water heating			7516.4670	(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			6651.8956	(286)
Target Primary Energy Rate (TPER)			58.5800	(287)

12 Appendix 2 – Be Green SAP Worksheets

Full SAP Calculation Printout

Property Reference	11577 1	**Issued on Date**	03/01/2024
Assessment Reference	Be Green - South PV	**Prop Type Ref**	Flat 1
Property	Corner of, Maryland Road & High Road, London, N22		

SAP Rating	90 B	**DER**	1.72	**TER**	11.12
Environmental	98 A	**% DER < TER**			84.53
CO_2 Emissions (t/year)	0.14	**DFEE**	33.11	**TFEE**	35.23
Compliance Check	See BREL	**% DFEE < TFEE**			6.00
% DPER < TPER	57.38	**DPER**	24.97	**TPER**	58.58

Assessor Details	Mr. Peter Kinsella	**Assessor ID**	L770-0002
Client			

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

---

1. Overall dwelling characteristics

	Area (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		4.0000	(17)
Infiltration rate		0.3409	(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) =	0.2898	(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	0.3694	0.3622	0.3550	0.3187	0.3115	0.2753	0.2753	0.2680	0.2898	0.3115	0.3260	0.3405	(22b)
Effective ac	0.5682	0.5656	0.5630	0.5508	0.5485	0.5379	0.5379	0.5359	0.5420	0.5485	0.5531	0.5580	(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	53.2371	52.9889	52.7455	51.6025	51.3886	50.3931	50.3931	50.2087	50.7765	51.3886	51.8212	52.2735	(38)

Heat transfer coeff

	117.8413	117.5930	117.3497	116.2066	115.9928	114.9972	114.9972	114.8128	115.3807	115.9928	116.4254	116.8777 (39)
Average = Sum(39)m / 12 =												116.2056

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0377	1.0355	1.0334	1.0233	1.0214	1.0127	1.0127	1.0110	1.0160	1.0214	1.0252	1.0292	(40)
HLP (average)												1.0233	
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)
Hot water usage for mixer showers												
	98.6515	97.1690	95.0086	90.8752	87.8248	84.4231	82.4895	84.6335	86.9837	90.6362	94.8584	98.2735 (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)												159.3636 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	173.2871	169.7570	165.3612	158.4456	152.9132	146.9321	144.4628	148.8377	153.4760	159.7773	166.8062	172.8044	(44)
Energy conte	274.4445	241.7316	254.1539	216.9041	205.8506	180.6701	174.7152	184.2922	189.2512	216.8163	237.6460	270.5700	(45)
Energy content (annual)										Total = Sum(45)m =		2647.0458	
Distribution loss (46)m = 0.15 x (45)m													
	41.1667	36.2597	38.1231	32.5356	30.8776	27.1005	26.2073	27.6438	28.3877	32.5224	35.6469	40.5855	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8640	(55)
Total storage loss													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(56)
If cylinder contains dedicated solar storage													
	26.7840	24.1920	26.7840	25.9200	26.7840	25.9200	26.7840	26.7840	25.9200	26.7840	25.9200	26.7840	(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													
	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(62)
WWHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63a)
PV diverter	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000	(63b)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63c)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63d)
Output from w/h													
	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(64)
										Total per year (kWh/year) = Sum(64)m =		3236.3018	(64)
12Total per year (kWh/year)												3236	(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													
	131.2899	116.5383	124.5433	110.8662	108.4824	98.8184	98.1299	101.3143	101.6716	112.1285	117.7629	130.0016	(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)													
	176.4649	173.4201	167.3969	153.9809	145.8097	137.2478	131.8951	136.1751	141.2106	150.7104	163.5596	174.7334	(72)
Total internal gains													
	665.4782	681.0448	652.0480	628.1326	595.6287	573.6975	551.2442	552.6542	569.8193	589.8184	627.0004	651.5435	(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	0.5000	0.0000	0.7700	76.6736	(76)
South	7.2000	46.7521	0.5000	0.0000	0.7700	129.5967	(78)

Solar gains	206.2703	362.2359	517.3758	665.8220	759.9252	758.3949	729.6900	660.3727	569.7120	406.9029	249.2193	175.0362	(83)
Total gains	871.7486	1043.2807	1169.4237	1293.9546	1355.5539	1332.0924	1280.9342	1213.0269	1139.5314	996.7213	876.2197	826.5797	(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	26.7686	26.8251	26.8807	27.1451	27.1952	27.4306	27.4306	27.4747	27.3395	27.1952	27.0941	26.9893	
alpha	2.7846	2.7883	2.7920	2.8097	2.8130	2.8287	2.8287	2.8316	2.8226	2.8130	2.8063	2.7993	
util living area													
	0.9395	0.9048	0.8554	0.7673	0.6488	0.5010	0.3772	0.4110	0.5961	0.8035	0.9092	0.9466	(86)
Living	19.2799	19.5588	19.9059	20.3088	20.6101	20.7946	20.8594	20.8499	20.7263	20.3195	19.7342	19.2303	
Non living	18.0330	18.3820	18.8129	19.3061	19.6554	19.8571	19.9150	19.9096	19.7910	19.3321	18.6137	17.9758	
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	20.1201	19.5588	19.9059	20.3088	20.6101	20.7946	20.8594	20.8499	20.7263	20.3195	19.7342	19.4779	(87)
Th 2	20.0520	20.0538	20.0556	20.0640	20.0655	20.0728	20.0728	20.0741	20.0700	20.0655	20.0624	20.0591	(88)
util rest of house													
	0.9314	0.8927	0.8371	0.7385	0.6056	0.4408	0.3037	0.3362	0.5369	0.7723	0.8956	0.9394	(89)
MIT 2	19.2471	18.3820	18.8129	19.3061	19.6554	19.8571	19.9150	19.9096	19.7910	19.3321	18.6137	18.3512	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	19.5181	18.7473	19.1522	19.6174	19.9517	20.1481	20.2082	20.2015	20.0813	19.6386	18.9615	18.7009	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5181	18.7473	19.1522	19.6174	19.9517	20.1481	20.2082	20.2015	20.0813	19.6386	18.9615	18.7009	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9262	0.8726	0.8169	0.7233	0.6000	0.4459	0.3148	0.3468	0.5376	0.7561	0.8761	0.9266	(94)
Useful gains	807.4439	910.3353	955.2982	935.8641	813.2918	593.9537	403.2063	420.6875	612.6541	753.6153	767.6617	765.8758	(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													
	1793.3194	1628.3432	1484.7257	1245.4319	957.1408	638.0191	414.9283	436.4619	690.1274	1048.4110	1380.9829	1694.8367	(97)
Space heating kWh													
	733.4914	482.5013	393.8940	222.8888	107.0237	0.0000	0.0000	0.0000	0.0000	219.3280	441.5913	691.1469	(98a)
Space heating requirement - total per year (kWh/year)												3291.8655	
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													
	733.4914	482.5013	393.8940	222.8888	107.0237	0.0000	0.0000	0.0000	0.0000	219.3280	441.5913	691.1469	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3291.8655	
Space heating per m2											(98c) / (4) =	28.9879	(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 %)	284.6034	(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													
	733.4914	482.5013	393.8940	222.8888	107.0237	0.0000	0.0000	0.0000	0.0000	219.3280	441.5913	691.1469	(98)
Space heating efficiency (main heating system 1)													
	284.6034	284.6034	284.6034	284.6034	284.6034	0.0000	0.0000	0.0000	0.0000	284.6034	284.6034	284.6034	(210)
Space heating fuel (main heating system)													
	257.7241	169.5347	138.4010	78.3156	37.6045	0.0000	0.0000	0.0000	0.0000	77.0644	155.1603	242.8456	(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													
	324.4909	286.9348	304.2003	265.3361	255.8970	229.1021	224.7616	234.3386	237.6832	266.8627	286.0780	320.6164	(64)
Efficiency of water heater												186.6628	(216)
(217)m	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	186.6628	(217)
Fuel for water heating, kWh/month													
	173.8380	153.7183	162.9679	142.1473	137.0905	122.7358	120.4105	125.5411	127.3330	142.9651	153.2593	171.7624	(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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	-46.1469	-68.1952	-102.5073	-118.4787	-129.1483	-117.7211	-116.0412	-108.1501	-93.7266	-78.2958	-51.3178	-39.3628	(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	-14.7082	-33.3544	-70.4434	-113.3093	-157.2062	-163.8111	-161.7704	-134.5753	-96.3760	-51.5219	-20.8651	-11.5625	(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	1156.6502	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	186.6628	
Water heating fuel used	1733.7691	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
Total electricity for the above, kWh/year	0.0000	(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	1079.4767	(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	1156.6502	0.1556	179.9667	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1733.7691	0.1411	244.5594	(264)
Space and water heating			424.5260	(265)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(267)
Energy for lighting	287.6532	0.1443	41.5172	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1069.0919	0.1342	-143.4747	
PV Unit electricity exported	-1029.5040	0.1238	-127.4414	
Total			-270.9162	(269)
Total CO2, kg/year			195.1271	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			1.7200	(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	1156.6502	1.5760	1822.8653	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1733.7691	1.5216	2638.0748	(278)
Space and water heating			4460.9401	(279)
Pumps, fans and electric keep-hot	0.0000	0.0000	0.0000	(281)
Energy for lighting	287.6532	1.5338	441.2120	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-1069.0919	1.4960	-1599.3378	
PV Unit electricity exported	-1029.5040	0.4543	-467.6793	
Total			-2067.0171	(283)
Total Primary energy kWh/year			2835.1350	(286)
Dwelling Primary energy Rate (DPER)			24.9700	(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)

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 200.0000 (47)

a) If manufacturer declared loss factor is known (kWh/day): 1.6525 (48)

Temperature factor from Table 2b 0.5400 (49)

Enter (49) or (54) in (55) 0.8924 (55)

Total storage loss

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)

If cylinder contains dedicated solar storage

27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss 23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss 0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)

Total heat required for water heating calculated for each month

282.7597	249.9928	265.2551	232.2592	224.5323	201.6421	198.4330	206.6381	209.2819	234.1989	250.0721	279.5308	(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

249.9601	220.9847	234.8794	207.1069	201.0913	181.5835	179.6312	186.6443	188.5285	209.7329	222.3551	247.3387	(64)
									Total per year (kWh/year) = Sum(64)m =		2529.8365	(64)

12Total per year (kWh/year) 2530 (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

117.8255	104.6266	112.0053	100.2661	98.4649	90.0860	89.7869	92.5151	92.6262	101.6791	106.1889	116.7519	(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)	158.3676	155.6943	150.5447	139.2585	132.3454	125.1194	120.6813	124.3483	128.6475	136.6654	147.4846	156.9246	(72)
Total internal gains	650.3810	666.3190	638.1957	616.4102	585.1643	561.5690	540.0304	540.8274	557.2562	578.7735	613.9254	636.7347	(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)
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	814.1184	953.8619	1048.8886	1144.9397	1188.3930	1163.5830	1119.2584	1065.0312	1009.4936	901.7730	811.7557	775.6784	(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, 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	0.9486	0.9219	0.8837	0.8109	0.7053	0.5600	0.4288	0.4633	0.6500	0.8363	0.9235	0.9541	(86)
MIT	18.7076	19.0477	19.4993	20.0648	20.5183	20.8231	20.9384	20.9220	20.7163	20.1191	19.3282	18.6558	(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	0.9414	0.9114	0.8679	0.7846	0.6632	0.4963	0.3470	0.3811	0.5902	0.8079	0.9114	0.9478	(89)
MIT 2	17.3552	17.7829	18.3477	19.0468	19.5816	19.9194	20.0253	20.0148	19.8137	19.1280	18.1491	17.2955	(90)
Living area fraction										fLA = Living area / (4) =		0.3104	(91)
MIT	17.7750	18.1755	18.7052	19.3628	19.8724	20.1999	20.3087	20.2964	20.0939	19.4357	18.5151	17.7178	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.7750	18.1755	18.7052	19.3628	19.8724	20.1999	20.3087	20.2964	20.0939	19.4357	18.5151	17.7178	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9188	0.8855	0.8410	0.7629	0.6545	0.5061	0.3693	0.4024	0.5926	0.7862	0.8865	0.9265	(94)
Useful gains	748.0526	844.6088	882.1447	873.5012	777.7610	588.9447	413.3090	428.5754	598.2697	708.9552	719.5890	718.6622	(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	1620.7758	1592.4493	1460.1527	1235.9769	963.1140	652.6144	432.2173	453.1473	701.5550	1041.2807	1351.7634	1608.7938	(97)
Space heating kWh	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(98a)
Space heating requirement - total per year (kWh/year)												3345.4515	
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	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3345.4515	
Space heating per m2											(98c) / (4) =	29.4598	(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)
Space heating requirement	649.3060	502.5488	430.0379	260.9825	137.9026	0.0000	0.0000	0.0000	0.0000	247.2501	455.1656	662.2579	(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)	703.4735	544.4733	465.9133	282.7546	149.4069	0.0000	0.0000	0.0000	0.0000	267.8767	493.1371	717.5058	(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	249.9601	220.9847	234.8794	207.1069	201.0913	181.5835	179.6312	186.6443	188.5285	209.7329	222.3551	247.3387	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.1008	85.8430	85.3978	84.5794	83.2316	79.8000	79.8000	79.8000	79.8000	84.4298	85.6305	86.1577	(217)
Fuel for water heating, kWh/month	290.3109	257.4288	275.0416	244.8667	241.6045	227.5483	225.1018	233.8901	236.2512	248.4110	259.6681	287.0766	(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												3624.5411	(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												3027.1996	(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	5580.8643	(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	3624.5411	0.2100	761.1536	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3027.1996	0.2100	635.7119	(264)
Space and water heating			1396.8656	(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			1262.4796	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			11.1200	(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	3624.5411	1.1300	4095.7315	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3027.1996	1.1300	3420.7355	(278)
Space and water heating			7516.4670	(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			6651.8956	(286)
Target Primary Energy Rate (TPER)			58.5800	(287)