BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

12 Canning Crescent, London

Job number: 12596

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0	16.12.2024	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 Bilal Ustun Ltd and in support of the planning application for the development named as 12 Canning Crescent, London comprising 9 apartments 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
- The Haringey Council Local Plan Policy SP4 Working Towards a Low Carbon Haringey Council

The above policies require:

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

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

- Thermal specification exceeding Part L 2021 notional U-values
- A design which limits air permeability
- A design which limits thermal bridging
- Energy saving building services including low energy lighting, waste water heat recovery
- Low carbon Air Source Heat Pumps and Solar PV Panels

This results in an 83% saving in CO2 emissions over Part L building regulations, of which 71% is from low and zero carbon technologies.

2 Existing and Proposed Development

The development site is located on land at 12 Canning Crescent, London. The development proposals are for nine apartments over four storeys.

The development proposals constitute a minor development.

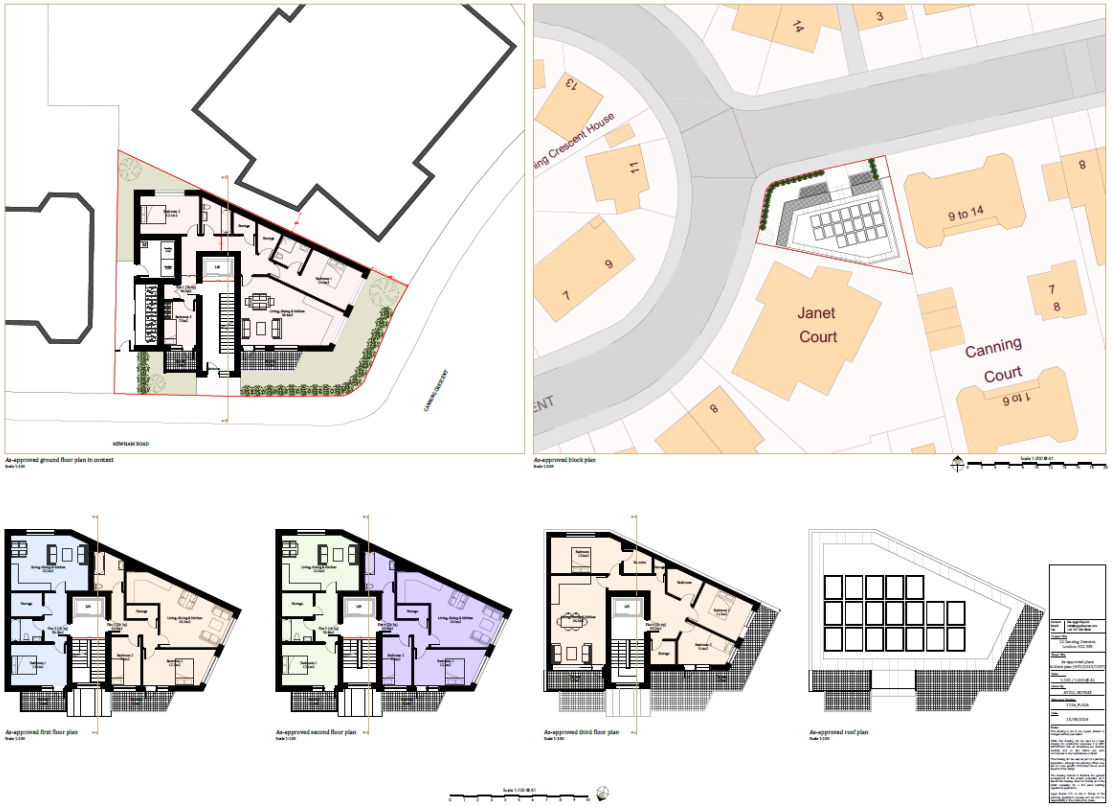


Figure 2.1: Site Location and proposals

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).

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 were feasible
    - A 10% CO2 reduction over Part L1 2021 through energy saving measures

4 Methodology

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

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

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

- Materials used for the construction and the thermal insulation of the building fabric (u-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 & CO_2

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

Table 5.1: Baseline CO_2

	CO_2 Emission Rate (kg CO_2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO_2/year)
Baseline	15.0	640	9,628

The **Total Baseline CO_2 Emissions** for the development are shown to be 9,628 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	0.11
Windows	1.6	1.2	1.2
Doors	1.6	1.0	1.2
Air permeability	8.00	5.00	4

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

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

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 85 lumens per watt
- Space & Water Heating: Condensing gas boiler 89.5% efficiency for new build baseline OR use same heating system type for conversions
- Ventilation: Natural ventilation with continuous extract fans
- Shower wastewater heat recovery systems

Table 6.1: Baseline vs Be Lean CO_2

	CO_2 Emission Rate (kg CO_2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO_2/year)	Reduction in CO_2
Baseline	15.0	640	9,628	N/A
Be Lean	14.4	640	8,546 (9,232 minus PV -1082)	**11%**

The **CO_2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 8,546 kg/year which is 11% saving. The notional PV for the dwelling is -1082.

7 Low Carbon Technology Review & Recommendations

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

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

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

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

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

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

WIND TURBINES

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

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

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

GROUND SOURCE HEAT PUMP (GSHP)

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

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

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

AIR SOURCE HEAT PUMP (ASHP)

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

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

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

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

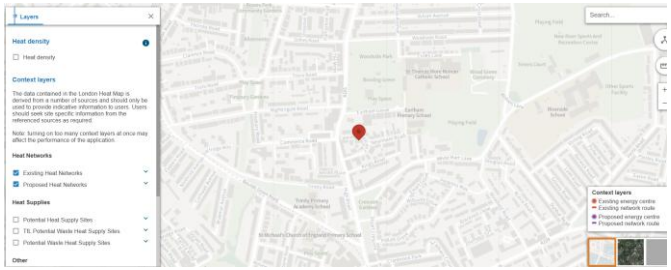
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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



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

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

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 250 Watts to 420 Watts depending on the manufacture.

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

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

SOLAR HOT WATER

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

- Mostly passive technology but requires pump energy
- Not suitable for combi boilers and developments without roof space
- Lower CO_2 reductions than other technologies

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

Low and Zero Carbon Technology Summary

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

ASHP, air to water assumed Mitsubishi Ecodan PUZ per dwelling, this will need to be checked with an installer.

Solar PV at 10.8 kWp horizontal angle, this will need to be checked with an installer.

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

8 Low Carbon Technology – Renewable Energy Generation - Be Green

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

Table 8.1: Baseline vs Be Green CO_2

	CO_2 Emission Rate (kg CO_2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO_2/year)	Reduction in CO_2
Baseline	15.0	640	9,628	N/A
Be Lean & Green Design	2.6	640	1,682	**83%**

The **CO_2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 000 kg/year.

Table 8.2: Baseline vs Be Green Energy Demand

	Energy Demand (kWh/m2/year)	Floor Area (m2)	Total Baseline Energy Demand (kWh/year)	Reduction in Energy Demand
Baseline	73.61	640	47,111	N/A
Be Lean & Green Design	29.32	640	18,765	**60%**

The **Energy Demand reduction** as a result of energy efficient fabric and services is shown to be 000 kWh per year

Table 5.2: Fabric Energy Efficiency

	Fabric Energy Efficiency (kWh/m2/year)
Baseline	43.3
Be Lean	35.3

9 Conclusion

Proposals are for the development named as 12 Canning Crescent comprising 9 apartments falling under the requirements of 12 Canning Crescent, London.

Under the local planning policy the proposed development is required to achieve a 35% saving in CO2 emissions over Part L building regulations and to be zero carbon were feasible.

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 and solar PV panels.

This results in an 83% saving in CO2 emissions over Part L building regulations, of which 71% is from low and zero carbon technologies.

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

10 Appendix 1 – Be Green SAP Worksheet – Flat 1

Full SAP Calculation Printout

Property Reference	S10992 01	**Issued on Date**	18/12/2024
Assessment Reference	Be Green	**Prop Type Ref**	Ground floor flat
Property	Flat 1 Lower Ground floor, 12 Canning Street, London		

SAP Rating	86 B	**DER**	2.97	**TER**	14.74
Environmental	97 A	**% DER < TER**			79.85
CO_2 Emissions (t/year)	0.26	**DFEE**	41.10	**TFEE**	47.71
Compliance Check	See BREL	**% DFEE < TFEE**			13.85
% DPER < TPER	57.55	**DPER**	33.38	**TPER**	78.64

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		102.0000	(1b)	x 2.5000	(2b) =	255.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.0000						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.0000	(5)

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2. Ventilation rate

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	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	1 * 10 =	10.0000	(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) =	10.0000 / (5) =	0.0392	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		4.0000	(17)
Infiltration rate		0.2392	(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) =	0.2033	(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	0.2592	0.2542	0.2491	0.2237	0.2186	0.1932	0.1932	0.1881	0.2033	0.2186	0.2288	0.2389	(22b)

Mechanical extract ventilation - decentralised

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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5092	0.5042	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(25)

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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	
Corridor door			1.8900	1.4000	2.6460			(26)
Windows (Uw = 1.00)			23.4000	0.9615	22.5000			(27)
Heat Loss Floor 1			102.0000	0.1100	11.2200			(28a)
External Wall 1	122.5000	23.4000	99.1000	0.1700	16.8470			(29a)
Corridor wall	40.0000	1.8900	38.1100	0.1700	6.4787			(29a)
Total net area of external elements Aum(A, m2)			264.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.6917			(33)
Party Ceilings 1			90.8200					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	13.2250	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	72.9167	(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	42.8534	42.4256	42.0750	42.0750	42.0750	42.0750	42.0750	42.0750	42.0750	42.0750	42.0750	42.0750	(38)
Heat transfer coeff													
	115.7701	115.3423	114.9917	114.9917	114.9917	114.9917	114.9917	114.9917	114.9917	114.9917	114.9917	114.9917	(39)
Average = Sum(39)m / 12 =												115.0858	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1350	1.1308	1.1274	1.1274	1.1274	1.1274	1.1274	1.1274	1.1274	1.1274	1.1274	1.1274	(40)
HLP (average)												1.1283	
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												2.7573	(42)
Hot water usage for mixer showers													
	88.0630	86.7396	84.8111	81.1213	78.3983	75.3617	73.6357	75.5496	77.6475	80.9080	84.6770	87.7256	(42a)
Hot water usage for baths													
	30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164	(42b)
Hot water usage for other uses													
	42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674	(42c)
Average daily hot water use (litres/day)												148.3648	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use													
	161.3495	158.0155	153.8921	147.4705	142.3103	136.7410	134.4889	138.5933	142.9379	148.7993	155.3243	160.9093	(44)
Energy conte	255.5382	225.0120	236.5264	201.8797	191.5771	168.1390	162.6526	171.6074	176.2567	201.9192	221.2880	251.9451	(45)
Energy content (annual)										Total = Sum(45)m =		2464.3415	
Distribution loss (46)m = 0.15 x (45)m													
	38.3307	33.7518	35.4790	30.2820	28.7366	25.2208	24.3979	25.7411	26.4385	30.2879	33.1932	37.7918	(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													
	310.4392	274.6000	291.4274	255.0097	246.4781	221.2690	217.5536	226.5084	229.3867	256.8202	274.4180	306.8461	(62)
WWHRS	-51.1327	-45.2222	-47.3540	-39.2110	-36.5433	-31.2703	-29.3110	-31.1693	-32.3535	-38.1412	-43.2093	-50.1858	(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													
	259.3066	229.3779	244.0733	215.7987	209.9348	189.9986	188.2427	195.3392	197.0333	218.6790	231.2086	256.6603	(64)
										Total per year (kWh/year) = Sum(64)m =		2635.6530	(64)
12Total per year (kWh/year)												2636	(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													
	128.8873	114.4869	122.5658	109.6290	107.6202	98.4102	98.0028	100.9803	101.1094	111.0589	116.0823	127.6925	(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	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	130.8986	144.9234	130.8986	135.2619	130.8986	135.2619	130.8986	130.8986	135.2619	130.8986	135.2619	130.8986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	(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)													
	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	(71)
Water heating gains (Table 5)													
	173.2356	170.3674	164.7390	152.2625	144.6508	136.6808	131.7242	135.7262	140.4297	149.2728	161.2253	171.6298	(72)
Total internal gains													
	628.0145	641.8642	615.4246	592.8642	562.6521	541.9051	521.1345	522.4434	538.2965	557.2236	591.7765	614.9579	(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	
North	10.5300	10.6334	0.5000	0.0000	0.7700	43.1083	(74)
South	4.2900	46.7521	0.5000	0.0000	0.7700	77.2180	(78)
Northwest	8.5800	11.2829	0.5000	0.0000	0.7700	37.2709	(81)

Solar gains	157.5973	284.7115	437.7658	631.4030	794.3713	828.5413	782.0751	653.3453	503.1443	327.1821	191.6058	133.0980	(83)
Total gains	785.6118	926.5757	1053.1904	1224.2671	1357.0234	1370.4464	1303.2096	1175.7887	1041.4409	884.4057	783.3824	748.0560	(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	61.1845	61.4114	61.5986	61.5986	61.5986	61.5986	61.5986	61.5986	61.5986	61.5986	61.5986	61.5986	
alpha	5.0790	5.0941	5.1066	5.1066	5.1066	5.1066	5.1066	5.1066	5.1066	5.1066	5.1066	5.1066	
util living area													
	0.9938	0.9853	0.9625	0.8848	0.7235	0.5264	0.3863	0.4457	0.7060	0.9337	0.9865	0.9952	(86)

Living	19.7854	20.0043	20.3101	20.6747	20.9075	20.9846	20.9974	20.9948	20.9386	20.6094	20.1287	19.7469	
Non living	18.5725	18.8522	19.2357	19.6666	19.9074	19.9706	19.9778	19.9768	19.9405	19.6043	19.0142	18.5281	
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	20.3786	20.0043	20.3101	20.6747	20.9075	20.9846	20.9974	20.9948	20.9386	20.6094	20.1287	19.9222	(87)
Th 2	19.9724	19.9758	19.9785	19.9785	19.9785	19.9785	19.9785	19.9785	19.9785	19.9785	19.9785	19.9785	(88)
util rest of house													
	0.9919	0.9807	0.9508	0.8524	0.6628	0.4470	0.2977	0.3489	0.6221	0.9070	0.9814	0.9936	(89)
MIT 2	19.4143	18.8522	19.2357	19.6666	19.9074	19.9706	19.9778	19.9768	19.9405	19.6043	19.0142	18.7894	(90)
Living area fraction										fLA = Living area / (4) =		0.3137	(91)
MIT	19.7168	19.2137	19.5728	19.9829	20.2212	20.2887	20.2977	20.2962	20.2536	19.9196	19.3639	19.1448	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.7168	19.2137	19.5728	19.9829	20.2212	20.2887	20.2977	20.2962	20.2536	19.9196	19.3639	19.1448	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9913	0.9762	0.9451	0.8526	0.6780	0.4716	0.3255	0.3793	0.6460	0.9051	0.9773	0.9919	(94)
Useful gains	778.7541	904.4821	995.3619	1043.7646	920.0435	646.2378	424.2588	446.0138	672.8072	800.4740	765.5917	741.9766	(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													
	1784.8085	1650.9729	1503.2623	1274.4387	979.8661	654.1545	425.1998	448.0294	707.6156	1071.6822	1410.2439	1718.5301	(97)
Space heating kWh													
	748.5045	501.6418	377.8780	166.0853	44.5081	0.0000	0.0000	0.0000	0.0000	201.7789	464.1495	726.5558	(98a)
Space heating requirement - total per year (kWh/year)												3231.1019	
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													
	748.5045	501.6418	377.8780	166.0853	44.5081	0.0000	0.0000	0.0000	0.0000	201.7789	464.1495	726.5558	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												3231.1019	
Space heating per m2											(98c) / (4) =	31.6775	(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 %)												285.0057	(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													
	748.5045	501.6418	377.8780	166.0853	44.5081	0.0000	0.0000	0.0000	0.0000	201.7789	464.1495	726.5558	(98)
Space heating efficiency (main heating system 1)													
	285.0057	285.0057	285.0057	285.0057	285.0057	0.0000	0.0000	0.0000	0.0000	285.0057	285.0057	285.0057	(210)
Space heating fuel (main heating system)													
	262.6279	176.0111	132.5861	58.2744	15.6166	0.0000	0.0000	0.0000	0.0000	70.7982	162.8562	254.9268	(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													
	259.3066	229.3779	244.0733	215.7987	209.9348	189.9986	188.2427	195.3392	197.0333	218.6790	231.2086	256.6603	(64)
Efficiency of water heater												186.8103	(216)
(217)m	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	186.8103	(217)
Fuel for water heating, kWh/month													
	138.8074	122.7865	130.6530	115.5175	112.3786	101.7067	100.7668	104.5655	105.4724	117.0594	123.7665	137.3909	(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	2.4308	2.1956	2.4308	2.3524	2.4308	2.3524	2.4308	2.4308	2.3524	2.4308	2.3524	2.4308	(231)
Lighting	33.0959	26.5507	23.9060	17.5146	13.5288	11.0531	12.3414	16.0418	20.8367	27.3389	30.8792	34.0157	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-15.8897	-27.4458	-48.7290	-64.5203	-76.2262	-73.2201	-71.7650	-63.3572	-49.4262	-34.3518	-18.7573	-13.0158	(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	-2.6805	-7.3907	-19.8380	-39.1597	-60.9079	-65.0199	-63.2263	-48.7785	-30.0618	-12.7880	-4.0523	-1.9833	(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												1133.6972	(211)
Space heating fuel - main system 2												0.0000	(213)
Space heating fuel - secondary												0.0000	(215)
Efficiency of water heater												186.8103	
Water heating fuel used												1410.8713	(219)
Space cooling fuel												0.0000	(221)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 1.4720, total flow = 16.0000, SFP = 0.0920)													
mechanical ventilation fans (SFP = 0.0920)												28.6212	(230a)
Total electricity for the above, kWh/year												28.6212	(231)
Electricity for lighting (calculated in Appendix L)												267.1027	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV generation												-912.5914	(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 1927.7011 (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	1133.6972	0.1565	177.4233	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1410.8713	0.1408	198.5868	(264)
Space and water heating			376.0101	(265)
Pumps, fans and electric keep-hot	28.6212	0.1387	3.9701	(267)
Energy for lighting	267.1027	0.1443	38.5512	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-556.7045	0.1315	-73.2293	
PV Unit electricity exported	-355.8868	0.1198	-42.6422	
Total			-115.8715	(269)
Total CO2, kg/year			302.6599	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.9700	(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	1133.6972	1.5794	1790.5052	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1410.8713	1.5205	2145.1629	(278)
Space and water heating			3935.6680	(279)
Pumps, fans and electric keep-hot	28.6212	1.5128	43.2982	(281)
Energy for lighting	267.1027	1.5338	409.6911	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-556.7045	1.4860	-827.2555	
PV Unit electricity exported	-355.8868	0.4395	-156.4117	
Total			-983.6673	(283)
Total Primary energy kWh/year			3404.9900	(286)
Dwelling Primary energy Rate (DPER)			33.3800	(287)

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

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1. Overall dwelling characteristics

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	102.0000 (1b)	x	2.5000 (2b)	=	255.0000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 102.0000						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	255.0000	(5)

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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) =	0.1569	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.4069	(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) =	0.3458	(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	0.4409	0.4323	0.4236	0.3804	0.3718	0.3285	0.3285	0.3199	0.3458	0.3718	0.3891	0.4064	(22b)
Effective ac	0.5972	0.5934	0.5897	0.5724	0.5691	0.5540	0.5540	0.5512	0.5598	0.5691	0.5757	0.5826	(25)

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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)			23.4000	1.1450	26.7939		(27)
Heat Loss Floor 1			102.0000	0.1300	13.2600		(28a)
External Wall 1	122.5000	23.4000	99.1000	0.1800	17.8380		(29a)
Corridor wall	40.0000	1.8900	38.1100	0.1800	6.8598		(29a)
Total net area of external elements Aum(A, m2)			264.5000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.6417		(33)

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

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	12.9000	0.0500	0.6450
E3 Sill	12.0000	0.0500	0.6000
E4 Jamb	27.6000	0.0500	1.3800
E5 Ground floor (normal)	63.5100	0.1600	10.1616
E16 Corner (normal)	10.0000	0.0900	0.9000

Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.6866 (36)

Point Thermal bridges (36a) = 0.0000

Total fabric heat loss (33) + (36) + (36a) = 80.3283 (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	50.2555	49.9378	49.6264	48.1640	47.8903	46.6166	46.6166	46.3807	47.1072	47.8903	48.4439	49.0226	(38)
Heat transfer coeff	130.5838	130.2661	129.9547	128.4923	128.2186	126.9449	126.9449	126.7090	127.4355	128.2186	128.7722	129.3509	(39)

Average = Sum(39)m / 12 = 128.4909

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2802	1.2771	1.2741	1.2597	1.2570	1.2446	1.2446	1.2422	1.2494	1.2570	1.2625	1.2681	(40)
HLP (average)												1.2597	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7573 (42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	70.4504	69.3917	67.8489	64.8970	62.7187	60.2894	58.9085	60.4396	62.1180	64.7264	67.7416	70.1805	(42a)
Hot water usage for baths	30.4192	29.9674	29.3312	28.1582	27.2799	26.3060	25.7799	26.4116	27.0995	28.1416	29.3388	30.3164	(42b)
Hot water usage for other uses	42.8674	41.3085	39.7497	38.1909	36.6321	35.0733	35.0733	36.6321	38.1909	39.7497	41.3085	42.8674	(42c)

Average daily hot water use (litres/day) 132.1266 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	143.7369	140.6676	136.9299	131.2462	126.6307	121.6686	119.7617	123.4834	127.4084	132.6177	138.3889	143.3642	(44)
Energy conte	227.6442	200.3088	210.4561	179.6695	170.4692	149.6058	144.8414	152.8982	157.1073	179.9610	197.1604	224.4737	(45)
Energy content (annual)										Total = Sum(45)m =		2194.5956	
Distribution loss (46)m = 0.15 x (45)m	34.1466	30.0463	31.5684	26.9504	25.5704	22.4409	21.7262	22.9347	23.5661	26.9941	29.5741	33.6710	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	274.2391	242.3946	257.0510	224.7613	217.0641	194.6976	191.4363	199.4931	202.1992	226.5559	242.2522	271.0686	(62)
WWHRS	-32.2070	-28.4841	-29.8269	-24.6979	-23.0175	-19.6963	-18.4621	-19.6326	-20.3785	-24.0240	-27.2163	-31.6106	(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	242.0321	213.9104	227.2241	200.0635	194.0466	175.0013	172.9742	179.8605	181.8206	202.5319	215.0359	239.4580	(64)
										Total per year (kWh/year) = Sum(64)m =		2443.9592	(64)
12Total per year (kWh/year)												2444	(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	112.9676	100.2713	107.2526	95.8136	93.9569	85.8174	85.4357	88.1146	88.3117	97.1129	101.6293	111.9134	(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	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	137.8642	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	130.8986	144.9234	130.8986	135.2619	130.8986	135.2619	130.8986	130.8986	135.2619	130.8986	135.2619	130.8986	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.5211	262.2141	255.4278	240.9805	222.7434	205.6032	194.1524	191.4594	198.2457	212.6930	230.9300	248.0703	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	36.7864	(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)	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	-110.2914	(71)
Water heating gains (Table 5)	151.8382	149.2132	144.1567	133.0744	126.2862	119.1908	114.8329	118.4336	122.6551	130.5282	141.1518	150.4213	(72)
Total internal gains	609.6171	623.7100	597.8423	576.6761	547.2875	524.4151	504.2432	505.1508	520.5219	541.4790	574.7030	596.7494	(73)

6. Solar gains

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

North				10.5300		10.6334		0.6300		0.7000		0.7700	34.2194 (74)
South				4.2900		46.7521		0.6300		0.7000		0.7700	61.2957 (78)
Northwest				8.5800		11.2829		0.6300		0.7000		0.7700	29.5857 (81)
Solar gains	125.1007	226.0040	347.4985	501.2077	630.5719	657.6960	620.8112	518.6255	399.3960	259.7171	152.0967	105.6532 (83)	
Total gains	734.7178	849.7140	945.3408	1077.8837	1177.8595	1182.1112	1125.0544	1023.7763	919.9179	801.1961	726.7997	702.4026 (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	54.2436	54.3759	54.5062	55.1265	55.2442	55.7985	55.7985	55.9024	55.5837	55.2442	55.0067	54.7606	
alpha	4.6162	4.6251	4.6337	4.6751	4.6829	4.7199	4.7199	4.7268	4.7056	4.6829	4.6671	4.6507	
util living area	0.9956	0.9908	0.9792	0.9368	0.8291	0.6458	0.4871	0.5515	0.8056	0.9611	0.9911	0.9965 (86)	
MIT	19.5122	19.7105	20.0147	20.4384	20.7774	20.9494	20.9891	20.9812	20.8573	20.4192	19.8985	19.4844 (87)	
Th 2	19.8564	19.8588	19.8612	19.8725	19.8746	19.8845	19.8845	19.8864	19.8807	19.8746	19.8703	19.8659 (88)	
util rest of house	0.9941	0.9877	0.9719	0.9142	0.7728	0.5499	0.3684	0.4268	0.7227	0.9426	0.9875	0.9953 (89)	
MIT 2	18.1425	18.3967	18.7830	19.3113	19.6922	19.8569	19.8813	19.8800	19.7856	19.3006	18.6457	18.1136 (90)	
Living area fraction										fLA = Living area / (4) =		0.3137 (91)	
MIT	18.5722	18.8089	19.1694	19.6649	20.0327	20.1996	20.2289	20.2255	20.1218	19.6515	19.0387	18.5436 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.5722	18.8089	19.1694	19.6649	20.0327	20.1996	20.2289	20.2255	20.1218	19.6515	19.0387	18.5436 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9917	0.9838	0.9659	0.9092	0.7816	0.5783	0.4059	0.4661	0.7428	0.9378	0.9838	0.9932 (94)	
Useful gains	728.6280	835.9223	913.1466	979.9647	920.6276	683.6691	456.6192	477.1701	683.2764	751.3822	715.0188	697.6174 (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	1863.7216	1811.8525	1646.4486	1383.2053	1068.4066	710.8450	460.6644	484.7229	767.3939	1160.5714	1537.3735	1855.3624 (97)	
Space heating kWh	844.5096	655.8251	545.5767	290.3332	109.9476	0.0000	0.0000	0.0000	0.0000	304.4368	592.0954	861.3623 (98a)	
Space heating requirement - total per year (kWh/year)												4204.0866	
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	844.5096	655.8251	545.5767	290.3332	109.9476	0.0000	0.0000	0.0000	0.0000	304.4368	592.0954	861.3623 (98c)	
Space heating requirement after solar contribution - total per year (kWh/year)												4204.0866	
Space heating per m2											(98c) / (4) =	41.2165 (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	844.5096	655.8251	545.5767	290.3332	109.9476	0.0000	0.0000	0.0000	0.0000	304.4368	592.0954	861.3623 (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)	914.9617	710.5364	591.0907	314.5539	119.1198	0.0000	0.0000	0.0000	0.0000	329.8340	641.4901	933.2202 (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	242.0321	213.9104	227.2241	200.0635	194.0466	175.0013	172.9742	179.8605	181.8206	202.5319	215.0359	239.4580 (64)	
Efficiency of water heater												79.8000 (216)	
(217)m	86.6238	86.4033	85.9498	84.8940	82.8365	79.8000	79.8000	79.8000	79.8000	84.9715	86.2096	86.6736 (217)	
Fuel for water heating, kWh/month	279.4061	247.5721	264.3683	235.6628	234.2526	219.2999	216.7597	225.3891	227.8454	238.3526	249.4338	276.2755 (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	27.1981	21.8194	19.6459	14.3934	11.1179	9.0834	10.1421	13.1831	17.1236	22.4670	25.3765	27.9541 (232)	
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-19.0080	-28.6011	-43.8382	-52.6555	-59.7580	-56.8554	-56.1431	-51.5009	-43.8795	-34.1276	-21.5210	-16.2289 (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	-5.8833	-12.7267	-25.9705	-40.0290	-53.9608	-54.6192	-53.9980	-45.2593	-32.5624	-18.5499	-7.9630	-4.6281 (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												4554.8068 (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	2914.6178	(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)	219.5046	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-840.2676	(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	6934.6616	(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	4554.8068	0.2100	956.5094	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	2914.6178	0.2100	612.0697	(264)
Space and water heating			1568.5792	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	219.5046	0.1443	31.6813	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-484.1173	0.1333	-64.5118	
PV Unit electricity exported	-356.1503	0.1251	-44.5672	
Total			-109.0790	(269)
Total CO2, kg/year			1503.1107	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			14.7400	(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	4554.8068	1.1300	5146.9316	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	2914.6178	1.1300	3293.5182	(278)
Space and water heating			8440.4498	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	219.5046	1.5338	336.6834	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-484.1173	1.4924	-722.5052	
PV Unit electricity exported	-356.1503	0.4593	-163.5789	
Total			-886.0841	(283)
Total Primary energy kWh/year			8021.1499	(286)
Target Primary Energy Rate (TPER)			78.6400	(287)