BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

1 Pinecote Drive

Job number: S10872

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0	29/03/2023	CT	PK	First Issue
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3	18/03/2024	CT	PK	Fourth edition

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 Bellview Group Limited and in support of the planning application for the development named as 1 Pinecote Drive comprising of the construction of one new build two storey detached dwelling falling under the requirements of Royal Windsor and Maidenhead district 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 Royal Windsor and Maidenhead Local Plan Policy SP2 Climate Change.

The above policies require:

- Near zero carbon.
- A 12 per cent contribution to energy demand from renewable technology

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 5
- A design which limits thermal bridging targeting the notional y value 0.050
- Energy saving building services including low energy lighting, wastewater heat recovery, heating controls and DMEV fans
- Low carbon Air Source Heat Pump and 1.6kWp of solar PV, Southeast facing with little or no shading.

This results in 70% reduction in CO2 over Part L 2013 and 73% CO2 reduction over Part L1 2021. With 24% contribution to energy demand from renewable technology.

2 Existing and Proposed Development

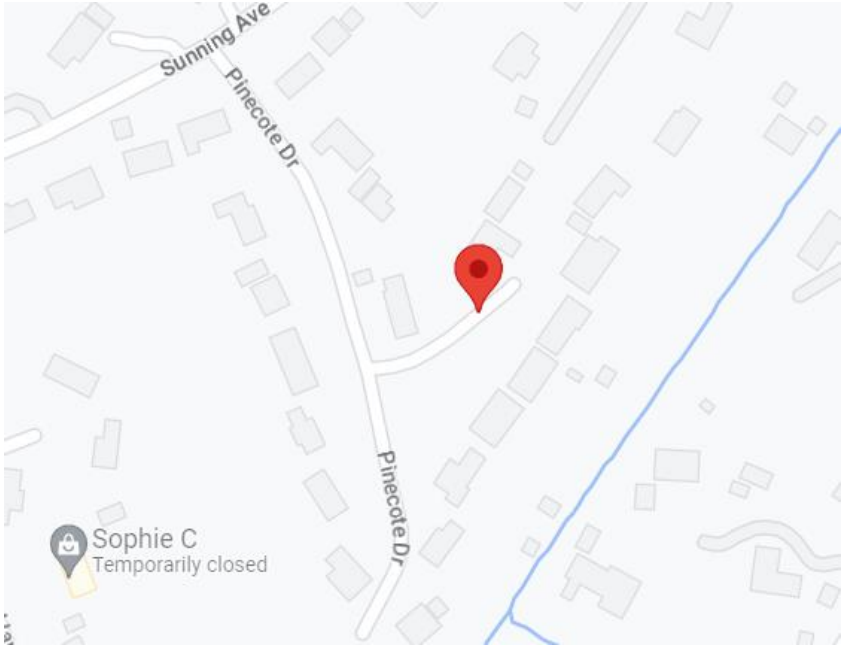
The development site is located on land at 1 Pinecote Drive, Sunningdale in Ascot.

The development proposals are for the construction of a two-storey detached dwelling.

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 relevant Royal Borough of Windsor and Maidenhead Local Planning Policy SP2 Climate Change requirements are as follows.

The development should target:

- Near to zero carbon
- A 12 per cent contribution to energy demand from renewable technology

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

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

Table 5.1: Baseline CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	20.67	363	7,503

The **Total Baseline CO2 Emissions** for the development are shown to be 7,503 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 2013 Limiting Parameters	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development
Walls	0.30	0.26	0.18	0.17
Ground Floor	0.25	0.18	0.13	0.10
Roof	0.20	0.16	0.11	0.11
Windows	2.00	1.6	1.2	1.2
Doors	2.00	1.6	1.0	0.95
Air permeability	10.00	8.00	5.00	5.00

- 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 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 80 lumens per watt.
- Space & Water Heating: Air Source Heat Pump.
- Heating Controls: Comprising time & temperature zone control.
- Ventilation: DMEV fans with an SFP 0.12 and 0.14.
- Wastewater heat recovery systems in the form of Power-Pipe E2-84 System A with a 60.3% efficiency and utilisation factor 0.947.

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, however more cost effective technologies are more suitable

AIR SOURCE HEAT PUMP (ASHP)

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

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

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

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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

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

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

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

SOLAR PHOTOVOLTAIC (PV)

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

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

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

SOLAR HOT WATER

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

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

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

Low Carbon Technology Summary

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

ASHP with Solar PV

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

8 Low Carbon Technology – Renewable Energy Generation - Be Green

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

Table 8.1: Baseline vs Be Lean CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	20.67	363	7,503	N/A
Lean & Green Design	6.14	363	2,228	**70%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 5,275 kg/year.

Table 8.2: Energy Demand Produced contributed to by renewable technologies (Solar PV)

	Total Baseline Energy Demand (kWh/year)	Total Energy Produced by Renewable Technology (kWh/year)	Reduction in Energy Demand
Lean & Green Design	5,684	1,382	**24%**

The Renewable technology contribution to **Energy Demand reduction** is shown to be 1,382 kWh per year.

9 Part L 2021 SAP compliance

To show compliance for current Building Regulations under Part L1 2021 we have used the same fabric build up and low carbon technologies. The results are shown below.

Table 9.1: Baseline Results – SAP 10 compliance

SAP 10	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	7.92	363	2,875	N/A
Lean & Green Design	2.16	363	784	**73%**

The **Total Be Green CO2 Emissions reduction** when calculated in **SAP 10** are shown to be 2,091 kg/year.

10 Conclusion

Proposals are for the development named as 1 Pinecote Drive in Sunningdale comprising the construction of one three storey detached dwelling falling under the requirements of The Royal Borough of Windsor and Maidenhead District Council.

Under the local planning policy, the proposed development is required to achieve near zero carbon with 12% contribution of energy demand to come from renewable technology.

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 1.6kWp of solar PV (on average 6 panels) with a fabric first approach and shower heat recovery.

This results in a 70% reduction in CO2 emissions over Part L 2013 with 24% of the final energy demand coming from low carbon technology.

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 – SAP 10 Be Green DER/TER

Full SAP Calculation Printout

Property Reference	S10872 01 180324	**Issued on Date**	18/03/2024
Assessment Reference	Be Green	**Prop Type Ref**	
Property	1, PINECOTE DRIVE, ASCOT, SL5 9PS		

SAP Rating	88 B	**DER**	2.16	**TER**	7.92
Environmental	97 A	**% DER < TER**			72.73
CO_2 Emissions (t/year)	0.69	**DFEE**	41.96	**TFEE**	42.75
Compliance Check	See BREL	**% DFEE < TFEE**			1.85
% DPER < TPER	47.72	**DPER**	22.10	**TPER**	42.28

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	169.0000 (1b)	x	2.6000 (2b)	=	439.4000	(1b) - (3b)
First floor	126.7500 (1c)	x	2.7000 (2c)	=	342.2250	(1c) - (3c)
Second floor	67.6900 (1d)	x	2.4100 (2d)	=	163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 363.4400						(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	944.7579	(5)

2. Ventilation rate

		m3 per hour	
Number of open chimneys	0 * 80 =	0.0000	(6a)
Number of open flues	0 * 20 =	0.0000	(6b)
Number of chimneys / flues attached to closed fire	0 * 10 =	0.0000	(6c)
Number of flues attached to solid fuel boiler	0 * 20 =	0.0000	(6d)
Number of flues attached to other heater	0 * 35 =	0.0000	(6e)
Number of blocked chimneys	0 * 20 =	0.0000	(6f)
Number of intermittent extract fans	0 * 10 =	0.0000	(7a)
Number of passive vents	0 * 10 =	0.0000	(7b)
Number of flueless gas fires	0 * 40 =	0.0000	(7c)
	Air changes per hour		
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(6c)+(6d)+(6e)+(6f)+(6g)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Pressure Test Method		Blower Door	
Measured/design AP50		5.0000	(17)
Infiltration rate		0.2500	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2500	(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	0.3187	0.3125	0.3063	0.2750	0.2687	0.2375	0.2375	0.2313	0.2500	0.2687	0.2812	0.2938	(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)

Effective ac	0.5687	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5312	0.5437	(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	
Windoe BFRC 0.5 (Uw = 1.20)			61.6800	1.1450	70.6260			(27)
Door 1.0			5.5200	0.9500	5.2440			(26)
Garage door			1.8900	1.4000	2.6460			(26)
Half glazed door			1.8900	1.2000	2.2680			(26a)
RL13			0.2700	1.1450	0.3092			(27a)
Heat Loss Floor 1			169.0000	0.1000	16.9000	75.0000	12675.0000	(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1700	36.5721	110.0000	23664.3000	(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1700	1.5215	9.0000	80.5500	(29a)
Stud wall	51.3500		51.3500	0.1600	8.2160	9.0000	462.1500	(29a)
Garage wall	18.7700	1.8900	16.8800	0.1600	2.7008	110.0000	1856.8000	(29a)
Flat ceing roof	62.3000		62.3000	0.1100	6.8530	9.0000	560.7000	(30)
Dormer roof	8.2000		8.2000	0.1100	0.9020	9.0000	73.8000	(30)
Pitched roof	49.1100	0.2700	48.8400	0.1100	5.3724	9.0000	439.5600	(30)
Ceiling joists	59.0700		59.0700	0.1100	6.4977	9.0000	531.6300	(30)

Total net area of external elements Aum(A, m2)	710.9700		(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =	166.6286	(33)
GF	362.5400	9.0000	3262.8600 (32c)
1st floor	249.6000	9.0000	2246.4000 (32c)
2nd floor	82.0200	9.0000	738.1800 (32c)
Internal Floor 1	126.7900	18.0000	2282.2200 (32d)
Internal Floor 2	67.6900	18.0000	1218.4200 (32d)
Internal Ceiling 1	126.7500	9.0000	1140.7500 (32e)
Internal Ceiling 2	67.6900	9.0000	609.2100 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	51842.5300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		142.6440 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		35.5485 (36)
Point Thermal bridges	(36a) =	0.0000
Total fabric heat loss	(33) + (36) + (36a) =	202.1771 (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	177.3192	175.3707	173.4221	163.6793	161.7307	155.8851	155.8851	155.8851	155.8851	161.7307	165.6279	169.5250	(38)
Heat transfer coeff	379.4964	377.5478	375.5992	365.8564	363.9079	358.0622	358.0622	358.0622	358.0622	363.9079	367.8050	371.7021	(39)
Average = Sum(39)m / 12 =												366.5059	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0442	1.0388	1.0335	1.0066	1.0013	0.9852	0.9852	0.9852	0.9852	1.0013	1.0120	1.0227	(40)
HLP (average)												1.0084	
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												3.2144	(42)
Hot water usage for mixer showers	107.4080	105.7938	103.4417	98.9414	95.6202	91.9166	89.8114	92.1457	94.7045	98.6812	103.2782	106.9964	(42a)
Hot water usage for baths	33.7152	33.2145	32.5093	31.2092	30.2357	29.1563	28.5732	29.2734	30.0358	31.1908	32.5177	33.6012	(42b)
Hot water usage for other uses	47.5487	45.8196	44.0906	42.3616	40.6325	38.9035	38.9035	40.6325	42.3616	44.0906	45.8196	47.5487	(42c)
Average daily hot water use (litres/day)												173.5119	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	188.6718	184.8279	180.0417	172.5122	166.4885	159.9763	157.2880	162.0516	167.1018	173.9626	181.6155	188.1463	(44)
Energy conte	298.8100	263.1925	276.7173	236.1605	224.1255	196.7095	190.2263	200.6537	206.0533	236.0656	258.7446	294.5917	(45)
Energy content (annual)										Total = Sum(45)m =		2882.0505	
Distribution loss (46)m = 0.15 x (45)m	44.8215	39.4789	41.5076	35.4241	33.6188	29.5064	28.5339	30.0981	30.9080	35.4098	38.8117	44.1887	(46)
Water storage loss:													
Store volume												300.0000	(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	353.7110	312.7805	331.6183	289.2905	279.0265	249.8395	245.1273	255.5547	259.1833	290.9666	311.8746	349.4927	(62)
WWHRS	-79.4770	-70.2902	-73.6038	-60.9469	-56.8003	-48.6044	-45.5589	-48.4473	-50.2880	-59.2840	-67.1616	-78.0053	(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	274.2340	242.4904	258.0145	228.3437	222.2262	201.2351	199.5684	207.1074	208.8953	231.6826	244.7130	271.4874	(64)
										Total per year (kWh/year) = Sum(64)m =		2789.9980	(64)
12Total per year (kWh/year)												2790	(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	143.2751	127.1819	135.9293	121.0274	118.4425	107.9099	107.1710	110.6382	111.0167	122.4126	128.5366	141.8725	(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	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	264.0019	292.2878	264.0019	272.8020	264.0019	272.8020	264.0019	264.0019	272.8020	264.0019	272.8020	264.0019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(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)	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)
Water heating gains (Table 5)	192.5741	189.2588	182.7007	168.0936	159.1970	149.8749	144.0471	148.7072	154.1899	164.5331	178.5230	190.6889	(72)
Total internal gains	1035.6129	1065.8531	1017.7298	983.6530	930.2707	896.2092	859.1750	858.5655	886.1274	915.9404	974.4160	1011.3212	(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	1.6800	10.6334	0.5000	0.0000	0.7700	6.8777	(74)
Northeast	40.8700	11.2829	0.5000	0.0000	0.7700	177.5365	(75)
East	2.7000	19.6403	0.5000	0.0000	0.7700	20.4161	(76)

Southeast				1.0200	36.7938	0.5000	0.0000	0.7700	14.4489	(77)			
Southwest				15.4100	36.7938	0.5000	0.0000	0.7700	218.2923	(79)			
Southwest				0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)			
Solar gains	441.6686	818.5958	1293.6912	1890.1358	2376.4357	2472.5697	2336.7180	1957.0879	1497.8471	951.7734	541.1433	370.0987	(83)
Total gains	1477.2815	1884.4488	2311.4211	2873.7888	3306.7063	3368.7789	3195.8930	2815.6534	2383.9745	1867.7137	1515.5593	1381.4199	(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	37.9469	38.1427	38.3406	39.3616	39.5724	40.2184	40.2184	40.2184	40.2184	39.5724	39.1531	38.7426	
alpha	3.5298	3.5428	3.5560	3.6241	3.6382	3.6812	3.6812	3.6812	3.6812	3.6382	3.6102	3.5828	
util living area	0.9955	0.9891	0.9721	0.9152	0.7934	0.6172	0.4738	0.5483	0.8002	0.9597	0.9912	0.9965	(86)
Living	19.2338	19.4569	19.8063	20.2884	20.6496	20.8417	20.8947	20.8800	20.7187	20.2195	19.6577	19.2244	
Non living	17.9398	18.2279	18.6752	19.2924	19.7205	19.9328	19.9772	19.9680	19.8196	19.2205	18.5018	17.9404	
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	20.0965	19.4569	19.8063	20.2884	20.6496	20.8417	20.8947	20.8800	20.7187	20.2195	19.6577	19.4727	(87)
Th 2	20.0467	20.0511	20.0555	20.0778	20.0823	20.0957	20.0957	20.0957	20.0957	20.0823	20.0733	20.0644	(88)
util rest of house	0.9946	0.9868	0.9661	0.8971	0.7517	0.5476	0.3840	0.4540	0.7434	0.9478	0.9891	0.9958	(89)
MIT 2	19.2067	18.2279	18.6752	19.2924	19.7205	19.9328	19.9772	19.9680	19.8196	19.2205	18.5018	18.3232	(90)
Living area fraction										fLA = Living area / (4) =		0.1222	(91)
MIT	19.3155	18.3781	18.8134	19.4141	19.8340	20.0439	20.0893	20.0795	19.9294	19.3426	18.6430	18.4636	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3155	18.3781	18.8134	19.4141	19.8340	20.0439	20.0893	20.0795	19.9294	19.3426	18.6430	18.4636	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9937	0.9811	0.9557	0.8812	0.7390	0.5434	0.3833	0.4523	0.7313	0.9350	0.9843	0.9940	(94)
Useful gains	1467.9352	1848.9145	2208.9264	2532.5201	2443.7184	1830.4673	1225.1159	1273.4097	1743.4844	1746.3792	1491.7084	1373.1517	(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	5698.3117	5088.6236	4624.9223	3846.6558	2960.0277	1949.2530	1249.3930	1317.4768	2087.3055	3181.4924	4245.5755	5301.8189	(97)
Space heating kWh	3147.4001	2177.0846	1797.5009	946.1777	384.1341	0.0000	0.0000	0.0000	0.0000	1067.7242	1982.7843	2922.9284	(98a)
Space heating requirement - total per year (kWh/year)												14425.7343	
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	3147.4001	2177.0846	1797.5009	946.1777	384.1341	0.0000	0.0000	0.0000	0.0000	1067.7242	1982.7843	2922.9284	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)												14425.7343	
Space heating per m2											(98c) / (4) =	39.6922	(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 %)												397.7890	(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	3147.4001	2177.0846	1797.5009	946.1777	384.1341	0.0000	0.0000	0.0000	0.0000	1067.7242	1982.7843	2922.9284	(98)
Space heating efficiency (main heating system 1)	397.7890	397.7890	397.7890	397.7890	397.7890	0.0000	0.0000	0.0000	0.0000	397.7890	397.7890	397.7890	(210)
Space heating fuel (main heating system)	791.2236	547.2964	451.8730	237.8592	96.5673	0.0000	0.0000	0.0000	0.0000	268.4147	498.4513	734.7937	(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	274.2340	242.4904	258.0145	228.3437	222.2262	201.2351	199.5684	207.1074	208.8953	231.6826	244.7130	271.4874	(64)
Efficiency of water heater												168.1772	(216)
(217)m	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	168.1772	(217)
Fuel for water heating, kWh/month	163.0625	144.1874	153.4182	135.7756	132.1381	119.6566	118.6655	123.1483	124.2114	137.7610	145.5090	161.4293	(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	15.0409	13.5854	15.0409	14.5557	15.0409	14.5557	15.0409	15.0409	14.5557	15.0409	14.5557	15.0409	(231)
Lighting	71.0769	57.0205	51.3407	37.6144	29.0544	23.7377	26.5044	34.4514	44.7490	58.7131	66.3163	73.0523	(232)
Electricity generated by PVs (Appendix M) (negative quantity)													
(233a)m	-34.3185	-53.3392	-84.1549	-101.9725	-114.5364	-105.9566	-104.5795	-95.1163	-79.5088	-63.4351	-39.1121	-28.9996	(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	3626.4792	(211)
Space heating fuel - main system 2	0.0000	(213)
Space heating fuel - secondary	0.0000	(215)
Efficiency of water heater	168.1772	
Water heating fuel used	1658.9628	(219)
Space cooling fuel	0.0000	(221)
Electricity for pumps and fans:		
(MEVDecentralised, Database: total watage = 9.3725, total flow = 61.0000, SFP = 0.1536)		
mechanical ventilation fans (SFP = 0.1536)	177.0949	(230a)
Total electricity for the above, kWh/year	177.0949	(231)
Electricity for lighting (calculated in Appendix L)	573.6313	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV generation	-905.0293	(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	5131.1389	(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	3626.4792	0.1555	563.9761	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	1658.9628	0.1407	233.4777	(264)
Space and water heating			797.4538	(265)
Pumps, fans and electric keep-hot	177.0949	0.1387	24.5652	(267)
Energy for lighting	573.6313	0.1443	82.7927	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-905.0293	0.1333	-120.6410	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-120.6410	(269)
Total CO2, kg/year			784.1708	(272)
EPC Dwelling Carbon Dioxide Emission Rate (DER)			2.1600	(273)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	3626.4792	1.5757	5714.3324	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	1658.9628	1.5204	2522.2649	(278)
Space and water heating			8236.5972	(279)
Pumps, fans and electric keep-hot	177.0949	1.5128	267.9091	(281)
Energy for lighting	573.6313	1.5338	879.8548	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-905.0293	1.4926	-1350.8423	
PV Unit electricity exported	0.0000	0.0000	0.0000	
Total			-1350.8423	(283)
Total Primary energy kWh/year			8033.5189	(286)
Dwelling Primary energy Rate (DPER)			22.1000	(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	169.0000	(1b)	x 2.6000	(2b)	= 439.4000	(1b) - (3b)
First floor	126.7500	(1c)	x 2.7000	(2c)	= 342.2250	(1c) - (3c)
Second floor	67.6900	(1d)	x 2.4100	(2d)	= 163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	363.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)		= 944.7579	(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) = 0.0423	(8)
Pressure test	Yes	
Pressure Test Method	Blower Door	

Measured/design AP50	5.0000	(17)
Infiltration rate	0.2923	(18)
Number of sides sheltered	0	(19)
Shelter factor (20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor (21) = (18) x (20) =	0.2923	(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	0.3727	0.3654	0.3581	0.3216	0.3143	0.2777	0.2777	0.2704	0.2923	0.3143	0.3289	0.3435	(22b)
Effective ac	0.5695	0.5668	0.5641	0.5517	0.5494	0.5386	0.5386	0.5366	0.5427	0.5494	0.5541	0.5590	(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			7.4100	1.0000	7.4100			(26)
TER Semi-glazed door			1.8900	1.0000	1.8900			(26a)
TER Opening Type (Uw = 1.20)			61.6800	1.1450	70.6260			(27)
RL13			0.2700	1.5038	0.4060			(27a)
Heat Loss Floor 1			169.0000	0.1300	21.9700			(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1800	38.7234			(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1800	1.6110			(29a)
Stud wall	51.3500		51.3500	0.1800	9.2430			(29a)
Garage wall	18.7700	1.8900	16.8800	0.1800	3.0384			(29a)
Flat ceing roof	62.3000		62.3000	0.1100	6.8530			(30)
Dormer roof	8.2000		8.2000	0.1100	0.9020			(30)
Pitched roof	49.1100	0.2700	48.8400	0.1100	5.3724			(30)
Ceiling joists	59.0700		59.0700	0.1100	6.4977			(30)
Total net area of external elements Aum(A, m2)			710.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		174.5429			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	142.6440	(35)

List of Thermal Bridges

	Length	Psi-value	Total
K1 Element			
E2 Other lintels (including other steel lintels)	38.4900	0.0500	1.9245
E3 Sill	34.3000	0.0500	1.7150
E4 Jamb	107.8400	0.0500	5.3920
E5 Ground floor (normal)	59.9200	0.1600	9.5872
E6 Intermediate floor within a dwelling	87.3500	0.0000	0.0000
E16 Corner (normal)	30.8400	0.0900	2.7756
R1 Head of roof window	0.6500	0.0800	0.0520
R2 Sill of roof window	0.6500	0.0600	0.0390
R3 Jamb of roof window	0.8200	0.0800	0.0656

Thermal bridges (Sum(L x Psi) calculated using Appendix K)	21.5509	(36)
Point Thermal bridges (36a) =	0.0000	
Total fabric heat loss (33) + (36) + (36a) =	196.0938	(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	177.5420	176.7011	175.8768	172.0050	171.2806	167.9084	167.9084	167.2839	169.2073	171.2806	172.7460	174.2781	(38)
Heat transfer coeff	373.6358	372.7948	371.9705	368.0987	367.3744	364.0022	364.0022	363.3777	365.3011	367.3744	368.8398	370.3719	(39)
Average = Sum(39)m / 12 =												368.0953	

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0281	1.0257	1.0235	1.0128	1.0108	1.0015	1.0015	0.9998	1.0051	1.0108	1.0149	1.0191	(40)
HLP (average)												1.0128	
Days in mont	31	28	31	30	31	30	31	31	30	31	30	31	

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.2144	(42)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage for mixer showers	78.1149	76.9410	75.2303	71.9574	69.5420	66.8484	65.3174	67.0150	68.8760	71.7681	75.1114	77.8156	(42a)
Hot water usage for baths	33.7152	33.2145	32.5093	31.2092	30.2357	29.1563	28.5732	29.2734	30.0358	31.1908	32.5177	33.6012	(42b)
Hot water usage for other uses	47.5487	45.8196	44.0906	42.3616	40.6325	38.9035	38.9035	40.6325	42.3616	44.0906	45.8196	47.5487	(42c)
Average daily hot water use (litres/day)												146.5047	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	159.3787	155.9751	151.8303	145.5282	140.4102	134.9081	132.7940	136.9209	141.2733	147.0495	153.4487	158.9655	(44)
Energy conte	252.4170	222.1064	233.3575	199.2208	189.0192	165.8853	160.6029	169.5367	174.2041	199.5448	218.6158	248.9015	(45)
Energy content (annual)										Total = Sum(45)m =		2433.4120	
Distribution loss (46)m = 0.15 x (45)m	37.8625	33.3160	35.0036	29.8831	28.3529	24.8828	24.0904	25.4305	26.1306	29.9317	32.7924	37.3352	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(61)
Total heat required for water heating calculated for each month	311.0458	275.0615	291.9863	255.9583	247.6480	222.6229	219.2317	228.1655	230.9417	258.1736	275.3534	307.5303	(62)
WWHRS	-35.7109	-31.5830	-33.0719	-27.3848	-25.5217	-21.8391	-20.4706	-21.7685	-22.5955	-26.6377	-30.1772	-35.0495	(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	275.3349	243.4785	258.9144	228.5735	222.1263	200.7838	198.7610	206.3970	208.3461	231.5360	245.1762	272.4808	(64)
										Total per year (kWh/year) = Sum(64)m =		2791.9086	(64)
12Total per year (kWh/year)												2792	(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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
130.8317	116.2144	124.4944	111.6310	109.7519	100.5469	100.3035	103.2740	103.3129	113.2517	118.0798	129.6628	(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 160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

264.0019	292.2878	264.0019	272.8020	264.0019	272.8020	264.0019	264.0019	272.8020	264.0019	272.8020	264.0019	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(69)
Pumps, fans 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)

-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)

Water heating gains (Table 5)

175.8490	172.9381	167.3312	155.0430	147.5160	139.6485	134.8165	138.8092	143.4902	152.2200	163.9997	174.2780	(72)

Total internal gains

1021.8878	1052.5324	1005.3604	973.6024	921.5897	885.9828	849.9444	848.6674	875.4277	906.6274	962.8927	997.9103	(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	1.6800	10.6334	0.6300	0.7000	0.7700	5.4595	(74)
Northeast	40.8700	11.2829	0.6300	0.7000	0.7700	140.9285	(75)
East	2.7000	19.6403	0.6300	0.7000	0.7700	16.2063	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
Southwest	15.4100	36.7938	0.6300	0.7000	0.7700	173.2804	(79)
Southwest	0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)

Solar gains	351.4414	651.3868	1029.4187	1503.8857	1890.6245	1967.0121	1858.9764	1557.0920	1191.8348	757.3624	430.5999	294.4880	(83)
Total gains	1373.3292	1703.9192	2034.7790	2477.4881	2812.2143	2852.9949	2708.9208	2405.7594	2067.2625	1663.9898	1393.4926	1292.3983	(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 38.5421	38.6290	38.7146	39.1218	39.1990	39.5621	39.5621	39.6301	39.4215	39.1990	39.0432	38.8817	
alpha 3.5695	3.5753	3.5810	3.6081	3.6133	3.6375	3.6375	3.6420	3.6281	3.6133	3.6029	3.5921	
util living area												
0.9965	0.9920	0.9808	0.9427	0.8523	0.6989	0.5521	0.6258	0.8541	0.9714	0.9933	0.9972	(86)
MIT 18.7491	19.0064	19.4279	20.0168	20.5264	20.8438	20.9506	20.9226	20.6489	19.9764	19.2640	18.7145	(87)
Th 2 20.0600	20.0619	20.0638	20.0727	20.0743	20.0820	20.0820	20.0835	20.0791	20.0743	20.0710	20.0675	(88)
util rest of house												
0.9957	0.9904	0.9765	0.9293	0.8170	0.6287	0.4517	0.5251	0.8050	0.9625	0.9916	0.9966	(89)
MIT 2 17.3794	17.7095	18.2481	18.9946	19.6101	19.9614	20.0558	20.0386	19.7686	18.9547	18.0460	17.3396	(90)
Living area fraction										fLA = Living area / (4) =		0.1222	(91)
MIT 17.5467	17.8680	18.3922	19.1195	19.7221	20.0693	20.1652	20.1466	19.8762	19.0795	18.1948	17.5076	(92)
Temperature adjustment											0.0000		
adjusted MIT 17.5467	17.8680	18.3922	19.1195	19.7221	20.0693	20.1652	20.1466	19.8762	19.0795	18.1948	17.5076	(93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation 0.9925	0.9843	0.9655	0.9114	0.8012	0.6276	0.4613	0.5326	0.7919	0.9488	0.9863	0.9940	(94)
Useful gains 1363.0856	1677.1770	1964.6684	2258.0334	2253.1338	1790.5514	1249.6534	1281.4227	1637.0361	1578.8460	1374.4053	1284.5998	(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												
4949.4527	4834.3980	4423.5616	3761.7798	2947.1065	1990.8194	1297.7312	1361.4295	2110.0531	3115.1538	4092.2077	4928.7602	(97)
Space heating kWh												
2668.2571	2121.6525	1829.4165	1082.6974	516.3156	0.0000	0.0000	0.0000	0.0000	1143.0130	1956.8178	2711.2553	(98a)
Space heating requirement - total per year (kWh/year)											14029.4253		
Solar heating kWh												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(98b)
Solar heating contribution - total per year (kWh/year)											0.0000		
Space heating kWh												
2668.2571	2121.6525	1829.4165	1082.6974	516.3156	0.0000	0.0000	0.0000	0.0000	1143.0130	1956.8178	2711.2553	(98c)
Space heating requirement after solar contribution - total per year (kWh/year)											14029.4253		
Space heating per m2										(98c) / (4) =		38.6018	(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												
2668.2571	2121.6525	1829.4165	1082.6974	516.3156	0.0000	0.0000	0.0000	0.0000	1143.0130	1956.8178	2711.2553	(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)												
2890.8528	2298.6484	1982.0331	1173.0200	559.3886	0.0000	0.0000	0.0000	0.0000	1238.3673	2120.0626	2937.4381	(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												
	275.3349	243.4785	258.9144	228.5735	222.1263	200.7838	198.7610	206.3970	208.3461	231.5360	245.1762	272.4808 (64)
Efficiency of water heater												79.8000 (216)
(217)m	87.8730	87.7808	87.5754	87.0879	85.8863	79.8000	79.8000	79.8000	79.8000	87.1445	87.6987	87.8947 (217)
Fuel for water heating, kWh/month												
	313.3328	277.3709	295.6473	262.4630	258.6284	251.6088	249.0740	258.6429	261.0854	265.6921	279.5664	310.0081 (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	54.8544	44.0062	39.6227	29.0293	22.4231	18.3198	20.4551	26.5883	34.5356	45.3125	51.1804	56.3790 (232)
Electricity generated by PVs (Appendix M) (negative quantity)												
(233a)m	-131.8763	-173.9952	-234.0472	-245.4180	-250.1739	-227.9989	-224.5845	-218.4682	-206.5104	-189.4300	-140.3880	-115.4080 (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	-115.5730	-236.8514	-459.9328	-675.9751	-880.3254	-880.1902	-870.3476	-743.4428	-553.4124	-334.2463	-152.7183	-91.9347 (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	15199.8108 (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	3283.1201 (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)	442.7063 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV generation	-8353.2484 (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	10658.3887 (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	15199.8108	0.2100	3191.9603	(261)
Total CO2 associated with community systems			0.0000	(373)
Water heating (other fuel)	3283.1201	0.2100	689.4552	(264)
Space and water heating			3881.4155	(265)
Pumps, fans and electric keep-hot	86.0000	0.1387	11.9293	(267)
Energy for lighting	442.7063	0.1443	63.8962	(268)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2358.2984	0.1361	-320.9860	
PV Unit electricity exported	-5994.9500	0.1265	-758.5627	
Total			-1079.5487	(269)
Total CO2, kg/year			2877.6922	(272)
EPC Target Carbon Dioxide Emission Rate (TER)			7.9200	(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	15199.8108	1.1300	17175.7862	(275)
Total CO2 associated with community systems			0.0000	(473)
Water heating (other fuel)	3283.1201	1.1300	3709.9257	(278)
Space and water heating			20885.7118	(279)
Pumps, fans and electric keep-hot	86.0000	1.5128	130.1008	(281)
Energy for lighting	442.7063	1.5338	679.0377	(282)
Energy saving/generation technologies				
PV Unit electricity used in dwelling	-2358.2984	1.5031	-3544.8054	
PV Unit electricity exported	-5994.9500	0.4645	-2784.6086	
Total			-6329.4141	(283)
Total Primary energy kWh/year			15365.4363	(286)
Target Primary Energy Rate (TPER)			42.2800	(287)

12 Appendix 2 - SAP 2013 Be Lean

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	S10872 01 180324	**Issued on Date**	18/03/2024
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	1, PINECOTE DRIVE, SUNNINGDALE, ASCOT, SL5 9PS		

SAP Rating	81 B	**DER**	15.79	**TER**	20.67
Environmental	83 B	**% DER<TER**	23.62		
CO_2 Emissions (t/year)	4.73	**DFEE**	45.64	**TFEE**	58.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.06		

Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk	**Assessor ID**	L770-0002
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 363 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 20.67 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.79 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.050

---
3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Air-to-water heat pump

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.27 kWh/day
Permitted by DBSCG 2.86 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power: 0.1200 0.1400
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.68 m², No overhang
Windows facing North East: 40.87 m², No overhang
Windows facing East: 2.70 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South West: 15.41 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 0.95 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	169.0000 (1b)	x	2.6000 (2b)	=	439.4000	(1b) - (3b)
First floor	126.7500 (1c)	x	2.7000 (2c)	=	342.2250	(1c) - (3c)
Second floor	67.6900 (1d)	x	2.4100 (2d)	=	163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	363.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	944.7579	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							0 * 10	=	0.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.2500	(18)
Number of sides sheltered				0	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2500	(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	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438	(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	
Windoe BFRC 0.5 (Uw = 1.20)			61.6800	1.1450	70.6260			(27)
Door 1.0			5.5200	0.9500	5.2440			(26)
Garage door			1.8900	1.4000	2.6460			(26)
Half glazed door			1.8900	1.2000	2.2680			(26a)
Roof light (Uw = 1.20)			0.2700	1.1450	0.3092			(27a)
Heat Loss Floor 1			169.0000	0.1000	16.9000	75.0000	12675.0000	(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1700	36.5721	110.0000	23664.3000	(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1700	1.5215	9.0000	80.5500	(29a)
Stud wall	51.3500		51.3500	0.1567	8.0456	9.0000	462.1500	(29a)
Garage wall	18.7700	1.8900	16.8800	0.1552	2.6202	110.0000	1856.8000	(29a)
Flat ceing roof	62.3000		62.3000	0.1100	6.8530	9.0000	560.7000	(30)
Dormer roof	8.2000		8.2000	0.1100	0.9020	9.0000	73.8000	(30)
Pitched roof	49.1100	0.2700	48.8400	0.1100	5.3724	9.0000	439.5600	(30)
Ceiling joists	59.0700		59.0700	0.1100	6.4977	9.0000	531.6300	(30)
Total net area of external elements Aum(A, m2)			710.9700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	166.3776			(33)
GF			362.5400			9.0000	3262.8600	(32c)
1st floor			249.6000			9.0000	2246.4000	(32c)
2nd floor			82.0200			9.0000	738.1800	(32c)
Internal Floor 1			126.7900			18.0000	2282.2200	(32d)
Internal Floor 2			67.6900			18.0000	1218.4200	(32d)
Internal Ceiling 1			126.7500			18.0000	2281.5000	(32e)
Internal Ceiling 2			67.6900			18.0000	1218.4200	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			53592.4900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4590	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							35.5485	(36)
Total fabric heat loss						(33) + (36) =	201.9261	(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	177.3192	175.3707	173.4221	163.6793	161.7307	155.8851	155.8851	155.8851	155.8851	161.7307	165.6279	169.5250	(38)
Heat transfer coeff	379.2453	377.2968	375.3482	365.6054	363.6568	357.8112	357.8112	357.8112	357.8112	363.6568	367.5540	371.4511	(39)
Average = Sum(39)m / 12 =												366.2549	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0435	1.0381	1.0328	1.0060	1.0006	0.9845	0.9845	0.9845	0.9845	1.0006	1.0113	1.0220	(40)
HLP (average)												1.0077	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.2144	(42)
Average daily hot water use (litres/day)												110.5420	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.5963	117.1746	112.7529	108.3312	103.9095	99.4878	99.4878	103.9095	108.3312	112.7529	117.1746	121.5963	(44)
Energy conte	180.3237	157.7123	162.7450	141.8850	136.1420	117.4802	108.8627	124.9215	126.4135	147.3227	160.8143	174.6339	(45)
Energy content (annual)										Total = Sum(45)m =		1739.2568	(45)
Distribution loss (46)m = 0.15 x (45)m	27.0486	23.6568	24.4117	21.2827	20.4213	17.6220	16.3294	18.7382	18.9620	22.0984	24.1221	26.1951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(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)
Total heat required for water heating calculated for each month	241.6559	213.1091	224.0771	201.2387	197.4742	176.8340	170.1949	186.2537	185.7672	208.6549	220.1680	235.9661	(62)
WWHRS	-61.5249	-54.1383	-55.2529	-45.4314	-42.1689	-34.7767	-29.4134	-35.6193	-36.6671	-45.3485	-52.5586	-59.4731	eq.(G10)
Total of WWHRS savings												-552.3730	
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	180.1310	158.9708	168.8243	155.8074	155.3053	142.0573	140.7815	150.6344	149.1002	163.3065	167.6094	176.4930	(64)
								Total per year (kWh/year) = Sum(64)m =				1909.0210	(64)
Heat gains from water heating, kWh/month	109.0234	96.7568	103.1784	94.6597	94.3330	86.5452	85.2626	90.6022	89.5155	98.0506	100.9537	107.1315	(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	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.6627	41.4454	33.7056	25.5173	19.0745	16.1035	17.4004	22.6177	30.3574	38.5457	44.9886	47.9596	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)
Water heating gains (Table 5)	146.5368	143.9833	138.6807	131.4719	126.7916	120.2016	114.6003	121.7771	124.3270	131.7884	140.2135	143.9940	(72)
Total internal gains	775.2363	772.7351	746.4136	702.7466	655.9379	612.8375	586.1266	593.2512	616.8200	660.7395	711.2931	751.5840	(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	1.6800	10.6334	0.5000	0.0000	0.7700	6.8777	(74)
Northeast	40.8700	11.2829	0.5000	0.0000	0.7700	177.5365	(75)
East	2.7000	19.6403	0.5000	0.0000	0.7700	20.4161	(76)
Southeast	1.0200	36.7938	0.5000	0.0000	0.7700	14.4489	(77)
Southwest	15.4100	36.7938	0.5000	0.0000	0.7700	218.2923	(79)
Southwest	0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)

Solar gains	441.6686	818.5958	1293.6912	1890.1358	2376.4357	2472.5697	2336.7180	1957.0879	1497.8471	951.7734	541.1433	370.0987	(83)
Total gains	1216.9050	1591.3309	2040.1048	2592.8824	3032.3736	3085.4072	2922.8446	2550.3391	2114.6672	1612.5129	1252.4364	1121.6827	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2538	39.4565	39.6613	40.7182	40.9364	41.6052	41.6052	41.6052	41.6052	40.9364	40.5024	40.0774	
alpha	3.6169	3.6304	3.6441	3.7145	3.7291	3.7737	3.7737	3.7737	3.7737	3.7291	3.7002	3.6718	
util living area	0.9979	0.9943	0.9823	0.9381	0.8293	0.6604	0.5133	0.5954	0.8470	0.9757	0.9958	0.9985	(86)
MIT	19.4138	19.5972	19.9075	20.3331	20.6684	20.8526	20.9061	20.8901	20.7249	20.2675	19.7764	19.4054	(87)
Th 2	20.0473	20.0517	20.0561	20.0784	20.0828	20.0963	20.0963	20.0963	20.0963	20.0828	20.0739	20.0650	(88)
util rest of house	0.9975	0.9930	0.9783	0.9236	0.7906	0.5896	0.4179	0.4967	0.7962	0.9678	0.9948	0.9982	(89)
MIT 2	17.8801	18.1511	18.6061	19.2324	19.6918	19.9265	19.9784	19.9668	19.7883	19.1504	18.4297	17.8805	(90)
Living area fraction										fLA = Living area / (4) =		0.1222	(91)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

MIT	18.0675	18.3278	18.7652	19.3669	19.8111	20.0397	20.0917	20.0796	19.9028	19.2869	18.5943	18.0668	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0675	18.3278	18.7652	19.3669	19.8111	20.0397	20.0917	20.0796	19.9028	19.2869	18.5943	18.0668	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9960	0.9897	0.9706	0.9096	0.7775	0.5848	0.4174	0.4947	0.7832	0.9584	0.9922	0.9971	(94)
Useful gains	1212.0880	1574.9547	1980.2078	2358.5677	2357.6860	1804.3311	1219.9221	1261.7361	1656.2489	1545.4240	1242.6048	1118.4260	(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	5221.2513	5066.2808	4603.7035	3826.7452	2949.6639	1946.3781	1249.3781	1316.6156	2076.2965	3159.0634	4224.7745	5150.8483	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	2982.8174	2346.1712	1951.8808	1057.0878	440.4315	0.0000	0.0000	0.0000	0.0000	1200.5477	2147.1622	3000.1222	(98)
Space heating												15126.2209	(98)
Space heating per m2											(98) / (4) =	41.6196	(99)

8c. Space cooling requirement

Not applicable

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 %)	170.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	8897.7770	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2982.8174	2346.1712	1951.8808	1057.0878	440.4315	0.0000	0.0000	0.0000	0.0000	1200.5477	2147.1622	3000.1222	(98)
Space heating efficiency (main heating system 1)	170.0000	170.0000	170.0000	170.0000	170.0000	0.0000	0.0000	0.0000	0.0000	170.0000	170.0000	170.0000	(210)
Space heating fuel (main heating system)	1754.5985	1380.1007	1148.1652	621.8164	259.0774	0.0000	0.0000	0.0000	0.0000	706.2045	1263.0366	1764.7778	(211)
Water heating requirement	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	180.1310	158.9708	168.8243	155.8074	155.3053	142.0573	140.7815	150.6344	149.1002	163.3065	167.6094	176.4930	(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	105.9594	93.5122	99.3084	91.6514	91.3561	83.5631	82.8126	88.6085	87.7060	96.0626	98.5938	103.8194	(219)
Water heating fuel used												1122.9535	(219)
Annual totals kWh/year													
Space heating fuel - main system												8897.7770	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 9.5220, total flow = 61.0000, SFP = 0.1561)													
mechanical ventilation fans (SFP = 0.1561)												179.9197	(230a)
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												209.9197	(231)
Electricity for lighting (calculated in Appendix L)												824.0775	(232)
Total delivered energy for all uses												11054.7277	(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	8897.7770	0.5190	4617.9463	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1122.9535	0.5190	582.8129	(264)
Space and water heating			5200.7591	(265)
Pumps and fans	209.9197	0.5190	108.9483	(267)
Energy for lighting	824.0775	0.5190	427.6962	(268)
Total CO2, kg/year			5737.4037	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.7900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.7900	ZC1
Total Floor Area	TFA	363.4400	
Assumed number of occupants	N	3.2144	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		8.2799	ZC2
CO2 emissions from cooking, equation (L16)		0.5397	ZC3
Total CO2 emissions		24.6096	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.6096	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	169.0000 (1b)	x	2.6000 (2b)	=	439.4000	(1b) - (3b)
First floor	126.7500 (1c)	x	2.7000 (2c)	=	342.2250	(1c) - (3c)
Second floor	67.6900 (1d)	x	2.4100 (2d)	=	163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	363.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	944.7579	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0423	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.2923	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2923	(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	0.3727	0.3654	0.3581	0.3216	0.3143	0.2777	0.2777	0.2704	0.2923	0.3143	0.3289	0.3435	(22b)
Effective ac	0.5695	0.5668	0.5641	0.5517	0.5494	0.5386	0.5386	0.5366	0.5427	0.5494	0.5541	0.5590	(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			7.4100	1.0000	7.4100			(26)
TER Semi-glazed door			1.8900	1.2000	2.2680			(26a)
TER Opening Type (Uw = 1.40)			61.6800	1.3258	81.7727			(27)
TER Room Window (Uw = 1.70)			0.2700	1.5918	0.4298			(27a)
Heat Loss Floor 1			169.0000	0.1300	21.9700			(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1800	38.7234			(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1800	1.6110			(29a)
Stud wall	51.3500		51.3500	0.1800	9.2430			(29a)
Garage wall	18.7700	1.8900	16.8800	0.1800	3.0384			(29a)
Flat ceing roof	62.3000		62.3000	0.1300	8.0990			(30)
Dormer roof	8.2000		8.2000	0.1300	1.0660			(30)
Pitched roof	49.1100	0.2700	48.8400	0.1300	6.3492			(30)
Ceiling joists	59.0700		59.0700	0.1300	7.6791			(30)
Total net area of external elements Aum(A, m2)			710.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		189.6596			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.5509	(36)
Total fabric heat loss	(33) + (36) =	211.2105	(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	177.5420	176.7011	175.8768	172.0050	171.2806	167.9084	167.9084	167.2839	169.2073	171.2806	172.7460	174.2781	(38)
Heat transfer coeff	388.7525	387.9116	387.0873	383.2155	382.4911	379.1189	379.1189	378.4944	380.4178	382.4911	383.9565	385.4886	(39)
Average = Sum(39)m / 12 =												383.2120	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0696	1.0673	1.0651	1.0544	1.0524	1.0431	1.0431	1.0414	1.0467	1.0524	1.0565	1.0607	(40)
HLP (average)												1.0544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.2144	(42)
Average daily hot water use (litres/day)	110.5420	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	121.5963	117.1746	112.7529	108.3312	103.9095	99.4878	99.4878	103.9095	108.3312	112.7529	117.1746	121.5963	(44)
Energy conte	180.3237	157.7123	162.7450	141.8850	136.1420	117.4802	108.8627	124.9215	126.4135	147.3227	160.8143	174.6339	(45)
Energy content (annual)										Total = Sum(45)m =		1739.2568	(45)
Distribution loss (46)m = 0.15 x (45)m													
	27.0486	23.6568	24.4117	21.2827	20.4213	17.6220	16.3294	18.7382	18.9620	22.0984	24.1221	26.1951	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(64)
								Total per year (kWh/year) = Sum(64)m =				2429.5638	(64)
Heat gains from water heating, kWh/month													
	106.8607	94.8034	101.0157	92.5668	92.1703	84.4522	83.0999	88.4395	87.4225	95.8879	98.8608	104.9688	(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	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.6627	41.4454	33.7056	25.5173	19.0745	16.1035	17.4004	22.6177	30.3574	38.5457	44.9886	47.9596	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)
Water heating gains (Table 5)													
	143.6300	141.0765	135.7739	128.5650	123.8848	117.2948	111.6934	118.8702	121.4202	128.8815	137.3067	141.0871	(72)
Total internal gains													
	772.3295	769.8283	743.5067	699.8397	653.0311	609.9306	583.2198	590.3443	613.9132	657.8327	708.3862	748.6771	(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	1.6800	10.6334	0.6300	0.7000	0.7700	5.4595	(74)
Northeast	40.8700	11.2829	0.6300	0.7000	0.7700	140.9285	(75)
East	2.7000	19.6403	0.6300	0.7000	0.7700	16.2063	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
Southwest	15.4100	36.7938	0.6300	0.7000	0.7700	173.2804	(79)
Southwest	0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)

Solar gains	351.4414	651.3868	1029.4187	1503.8857	1890.6245	1967.0121	1858.9764	1557.0920	1191.8348	757.3624	430.5999	294.4880	(83)
Total gains	1123.7709	1421.2150	1772.9254	2203.7255	2543.6556	2576.9427	2442.1962	2147.4363	1805.7480	1415.1951	1138.9861	1043.1652	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.9228	65.0635	65.2021	65.8608	65.9856	66.5725	66.5725	66.6823	66.3452	65.9856	65.7337	65.4725	
alpha	5.3282	5.3376	5.3468	5.3907	5.3990	5.4382	5.4382	5.4455	5.4230	5.3990	5.3822	5.3648	
util living area													
	0.9999	0.9997	0.9986	0.9904	0.9472	0.8182	0.6532	0.7447	0.9549	0.9976	0.9998	1.0000	(86)
MIT	19.5921	19.7342	19.9915	20.3545	20.6980	20.9162	20.9808	20.9626	20.7628	20.3249	19.8963	19.5728	(87)
Th 2	20.0257	20.0276	20.0295	20.0382	20.0399	20.0475	20.0475	20.0490	20.0446	20.0399	20.0366	20.0331	(88)
util rest of house													
	0.9999	0.9996	0.9980	0.9861	0.9220	0.7386	0.5267	0.6211	0.9222	0.9961	0.9997	0.9999	(89)
MIT 2	18.1091	18.3186	18.6964	19.2312	19.7144	19.9850	20.0396	20.0307	19.8146	19.1918	18.5625	18.0862	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.2904	18.4916	18.8546	19.3684	19.8346	20.0988	20.1546	20.1446	19.9305	19.3302	18.7255	18.2678	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2904	18.4916	18.8546	19.3684	19.8346	20.0988	20.1546	20.1446	19.9305	19.3302	18.7255	18.2678	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9993	0.9969	0.9818	0.9151	0.7434	0.5418	0.6349	0.9169	0.9944	0.9995	0.9999	(94)
Useful gains	1123.5708	1420.2656	1767.3774	2163.5396	2327.7819	1915.8165	1323.2670	1363.4514	1655.6409	1407.2474	1138.4416	1043.0435	(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													
	5438.7864	5272.3267	4782.3216	4011.6689	3111.4138	2084.6934	1347.6093	1417.2984	2218.0190	3339.2419	4463.6729	5422.9874	(97)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	3210.5204	2588.5850	2243.1184	1330.6531	583.0221	0.0000	0.0000	0.0000	0.0000	1437.4039	2394.1666	3258.6783	(98)
Space heating												17046.1478	(98)
Space heating per m2											(98) / (4) =	46.9022	(99)

8c. Space cooling requirement

Not applicable

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 %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												18231.1741	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3210.5204	2588.5850	2243.1184	1330.6531	583.0221	0.0000	0.0000	0.0000	0.0000	1437.4039	2394.1666	3258.6783	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	3433.7117	2768.5401	2399.0572	1423.1584	623.5531	0.0000	0.0000	0.0000	0.0000	1537.3304	2560.6059	3485.2174	(211)
Water heating requirement													
	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													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(64)
Efficiency of water heater												79.8000	(216)
(217)m	89.6671	89.5959	89.4230	88.9509	87.5600	79.8000	79.8000	79.8000	79.8000	89.0044	89.5004	89.6966	(217)
Fuel for water heating, kWh/month													
	266.4884	235.1306	247.5581	223.2945	222.4427	218.3180	209.8891	230.0130	229.5126	231.3949	243.0737	260.0575	(219)
Water heating fuel used												2817.1731	(219)
Annual totals kWh/year													
Space heating fuel - main system												18231.1741	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												824.0775	(232)
Total delivered energy for all uses												21947.4248	(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	18231.1741	0.2160	3937.9336	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2817.1731	0.2160	608.5094	(264)
Space and water heating			4546.4430	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	824.0775	0.5190	427.6962	(268)
Total CO2, kg/m2/year			5013.0642	(272)
Emissions per m2 for space and water heating			12.5095	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.1768	(272b)
Emissions per m2 for pumps and fans			0.1071	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5095 * 1.55) + 1.1768 + 0.1071, rounded to 2 d.p.			20.6700	(273)

13 Appendix 3 - SAP 2013 Be Green

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	S10872 01 180324	**Issued on Date**	18/03/2024
Assessment Reference	Be Green	**Prop Type Ref**	
Property	1, PINECOTE DRIVE, SUNNINGDALE, ASCOT, SL5 9PS		

SAP Rating	92 A	**DER**	6.14	**TER**	20.67
Environmental	93 A	**% DER<TER**	70.30		
CO_2 Emissions (t/year)	1.77	**DFEE**	45.64	**TFEE**	58.56
General Requirements Compliance	Pass	**% DFEE<TFEE**	22.06		

Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk	**Assessor ID**	L770-0002
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 363 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 20.67 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 6.14 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.050

---
3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi Electric Ecodan 14.0 kW PUZ-HWM140VHA

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Nominal cylinder loss: 2.27 kWh/day
Permitted by DBSCG 2.86 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous extract system (decentralised)
Specific fan power: 0.1200 0.1400
Maximum 0.7 OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 1.68 m², No overhang
Windows facing North East: 40.87 m², No overhang
Windows facing East: 2.70 m², No overhang
Windows facing South East: 1.02 m², No overhang
Windows facing South West: 15.41 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.11 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 0.95 W/m²K
Photovoltaic array 1.60 kW

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	169.0000 (1b)	x	2.6000 (2b)	=	439.4000	(1b) - (3b)
First floor	126.7500 (1c)	x	2.7000 (2c)	=	342.2250	(1c) - (3c)
Second floor	67.6900 (1d)	x	2.4100 (2d)	=	163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	363.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	944.7579	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							0 * 10	=	0.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.2500	(18)
Number of sides sheltered				0	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.2500	(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	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438	(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	
Windoe BFRC 0.5 (Uw = 1.20)			61.6800	1.1450	70.6260			(27)
Door 1.0			5.5200	0.9500	5.2440			(26)
Garage door			1.8900	1.4000	2.6460			(26)
Half glazed door			1.8900	1.2000	2.2680			(26a)
Roof light (Uw = 1.20)			0.2700	1.1450	0.3092			(27a)
Heat Loss Floor 1			169.0000	0.1000	16.9000	75.0000	12675.0000	(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1700	36.5721	110.0000	23664.3000	(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1700	1.5215	9.0000	80.5500	(29a)
Stud wall	51.3500		51.3500	0.1567	8.0456	9.0000	462.1500	(29a)
Garage wall	18.7700	1.8900	16.8800	0.1552	2.6202	110.0000	1856.8000	(29a)
Flat ceing roof	62.3000		62.3000	0.1100	6.8530	9.0000	560.7000	(30)
Dormer roof	8.2000		8.2000	0.1100	0.9020	9.0000	73.8000	(30)
Pitched roof	49.1100	0.2700	48.8400	0.1100	5.3724	9.0000	439.5600	(30)
Ceiling joists	59.0700		59.0700	0.1100	6.4977	9.0000	531.6300	(30)
Total net area of external elements Aum(A, m2)			710.9700					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	166.3776			(33)
GF			362.5400			9.0000	3262.8600	(32c)
1st floor			249.6000			9.0000	2246.4000	(32c)
2nd floor			82.0200			9.0000	738.1800	(32c)
Internal Floor 1			126.7900			18.0000	2282.2200	(32d)
Internal Floor 2			67.6900			18.0000	1218.4200	(32d)
Internal Ceiling 1			126.7500			18.0000	2281.5000	(32e)
Internal Ceiling 2			67.6900			18.0000	1218.4200	(32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			53592.4900	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							147.4590	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							35.5485	(36)
Total fabric heat loss						(33) + (36) =	201.9261	(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	177.3192	175.3707	173.4221	163.6793	161.7307	155.8851	155.8851	155.8851	155.8851	161.7307	165.6279	169.5250	(38)
Heat transfer coeff	379.2453	377.2968	375.3482	365.6054	363.6568	357.8112	357.8112	357.8112	357.8112	363.6568	367.5540	371.4511	(39)
Average = Sum(39)m / 12 =												366.2549	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0435	1.0381	1.0328	1.0060	1.0006	0.9845	0.9845	0.9845	0.9845	1.0006	1.0113	1.0220	(40)
HLP (average)												1.0077	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.2144	(42)
Average daily hot water use (litres/day)												110.5420	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	121.5963	117.1746	112.7529	108.3312	103.9095	99.4878	99.4878	103.9095	108.3312	112.7529	117.1746	121.5963	(44)
Energy conte	180.3237	157.7123	162.7450	141.8850	136.1420	117.4802	108.8627	124.9215	126.4135	147.3227	160.8143	174.6339	(45)
Energy content (annual)										Total = Sum(45)m =		1739.2568	(45)
Distribution loss (46)m = 0.15 x (45)m	27.0486	23.6568	24.4117	21.2827	20.4213	17.6220	16.3294	18.7382	18.9620	22.0984	24.1221	26.1951	(46)
Water storage loss:													
Store volume												300.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.7368	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												1.2281	(55)
Total storage loss	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(56)
If cylinder contains dedicated solar storage	38.0698	34.3856	38.0698	36.8417	38.0698	36.8417	38.0698	38.0698	36.8417	38.0698	36.8417	38.0698	(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)
Total heat required for water heating calculated for each month	241.6559	213.1091	224.0771	201.2387	197.4742	176.8340	170.1949	186.2537	185.7672	208.6549	220.1680	235.9661	(62)
WWHRS	-61.5249	-54.1383	-55.2529	-45.4314	-42.1689	-34.7767	-29.4134	-35.6193	-36.6671	-45.3485	-52.5586	-59.4731	eq.(G10)
Total of WWHRS savings												-552.3730	
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h	180.1310	158.9708	168.8243	155.8074	155.3053	142.0573	140.7815	150.6344	149.1002	163.3065	167.6094	176.4930	(64)
								Total per year (kWh/year) = Sum(64)m =				1909.0210	(64)
Heat gains from water heating, kWh/month	109.0234	96.7568	103.1784	94.6597	94.3330	86.5452	85.2626	90.6022	89.5155	98.0506	100.9537	107.1315	(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	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.6627	41.4454	33.7056	25.5173	19.0745	16.1035	17.4004	22.6177	30.3574	38.5457	44.9886	47.9596	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(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)	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)
Water heating gains (Table 5)	146.5368	143.9833	138.6807	131.4719	126.7916	120.2016	114.6003	121.7771	124.3270	131.7884	140.2135	143.9940	(72)
Total internal gains	772.2363	769.7351	743.4136	699.7466	652.9379	609.8375	583.1266	590.2512	613.8200	657.7395	708.2931	748.5840	(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	1.6800	10.6334	0.5000	0.0000	0.7700	6.8777	(74)
Northeast	40.8700	11.2829	0.5000	0.0000	0.7700	177.5365	(75)
East	2.7000	19.6403	0.5000	0.0000	0.7700	20.4161	(76)
Southeast	1.0200	36.7938	0.5000	0.0000	0.7700	14.4489	(77)
Southwest	15.4100	36.7938	0.5000	0.0000	0.7700	218.2923	(79)
Southwest	0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)

Solar gains	441.6686	818.5958	1293.6912	1890.1358	2376.4357	2472.5697	2336.7180	1957.0879	1497.8471	951.7734	541.1433	370.0987	(83)
Total gains	1213.9050	1588.3309	2037.1048	2589.8824	3029.3736	3082.4072	2919.8446	2547.3391	2111.6672	1609.5129	1249.4364	1118.6827	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2538	39.4565	39.6613	40.7182	40.9364	41.6052	41.6052	41.6052	41.6052	40.9364	40.5024	40.0774	
alpha	3.6169	3.6304	3.6441	3.7145	3.7291	3.7737	3.7737	3.7737	3.7737	3.7291	3.7002	3.6718	
util living area	0.9979	0.9943	0.9824	0.9383	0.8296	0.6608	0.5137	0.5959	0.8474	0.9758	0.9959	0.9985	(86)
Tweekday	17.8788	18.1499	18.6049	19.2314	19.6913	19.9264	19.9783	19.9667	19.7878	19.1493	18.4285	17.8792	
Tweekend	19.9740	20.0926	20.2932	20.5684	20.7853	20.9046	20.9393	20.9289	20.8219	20.5259	20.2084	19.9686	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.4165	19.5963	19.9092	20.3261	20.6687	20.8535	20.9063	20.8902	20.7218	20.2684	19.7640	19.4082	(87)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Th 2	20.0473	20.0517	20.0561	20.0784	20.0828	20.0963	20.0963	20.0963	20.0963	20.0828	20.0739	20.0650	(88)
util rest of house	0.9975	0.9931	0.9784	0.9238	0.7910	0.5900	0.4183	0.4972	0.7968	0.9680	0.9948	0.9982	(89)
Tweekday	17.8788	18.1499	18.6049	19.2314	19.6913	19.9264	19.9783	19.9667	19.7878	19.1493	18.4285	17.8792	
Tweekend	17.8788	18.1499	18.6049	19.2314	19.6913	19.9264	19.9783	19.9667	19.7878	19.1493	18.4285	17.8792	
MIT 2	17.8788	18.1499	18.6049	19.2314	19.6913	19.9264	19.9783	19.9667	19.7878	19.1493	18.4285	17.8792	(90)
Living area fraction										fLA = Living area / (4) =		0.1222	(91)
MIT	18.0667	18.3266	18.7643	19.3652	19.8107	20.0396	20.0917	20.0796	19.9019	19.2860	18.5917	18.0660	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.0667	18.3266	18.7643	19.3652	19.8107	20.0396	20.0917	20.0796	19.9019	19.2860	18.5917	18.0660	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9961	0.9898	0.9708	0.9099	0.7779	0.5852	0.4178	0.4952	0.7837	0.9586	0.9922	0.9971	(94)
Useful gains	1209.1382	1572.0791	1977.5436	2356.4232	2356.5009	1803.9524	1219.8219	1261.5300	1654.9796	1542.8886	1239.6982	1115.4635	(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	5220.9512	5065.8233	4603.3889	3826.1281	2949.5114	1946.3634	1249.3715	1316.5949	2075.9940	3158.7363	4223.8039	5150.5512	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	2984.7888	2347.7961	1953.6289	1058.1876	441.1998	0.0000	0.0000	0.0000	0.0000	1202.1906	2148.5561	3002.1052	(98)
Space heating												15138.4532	(98)
Space heating per m2											(98) / (4) =	41.6532	(99)

8c. Space cooling requirement

Not applicable

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 %)	426.5467	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	3549.0730	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2984.7888	2347.7961	1953.6289	1058.1876	441.1998	0.0000	0.0000	0.0000	0.0000	1202.1906	2148.5561	3002.1052	(98)
Space heating efficiency (main heating system 1)	426.5467	426.5467	426.5467	426.5467	426.5467	0.0000	0.0000	0.0000	0.0000	426.5467	426.5467	426.5467	(210)
Space heating fuel (main heating system)	699.7567	550.4195	458.0106	248.0825	103.4353	0.0000	0.0000	0.0000	0.0000	281.8427	503.7095	703.8163	(211)
Water heating requirement	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	180.1310	158.9708	168.8243	155.8074	155.3053	142.0573	140.7815	150.6344	149.1002	163.3065	167.6094	176.4930	(64)
Efficiency of water heater												168.7200	(216)
(217)m	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	168.7200	(217)
Fuel for water heating, kWh/month	106.7633	94.2216	100.0618	92.3467	92.0491	84.1971	83.4409	89.2807	88.3714	96.7914	99.3418	104.6070	(219)
Water heating fuel used												1131.4728	(219)
Annual totals kWh/year													
Space heating fuel - main system												3549.0730	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 9.5220, total flow = 61.0000, SFP = 0.1561)													
mechanical ventilation fans (SFP = 0.1561)												179.9197	(230a)
Total electricity for the above, kWh/year												179.9197	(231)
Electricity for lighting (calculated in Appendix L)												824.0775	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.60 * 1080 * 1.00) =										-1381.7915		-1381.7915	(233)
Total delivered energy for all uses												4302.7515	(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	3549.0730	0.5190	1841.9689	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1131.4728	0.5190	587.2344	(264)
Space and water heating			2429.2033	(265)
Pumps and fans	179.9197	0.5190	93.3783	(267)
Energy for lighting	824.0775	0.5190	427.6962	(268)
Energy saving/generation technologies				
PV Unit	-1381.7915	0.5190	-717.1498	(269)
Total CO2, kg/year			2233.1280	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			6.1400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		6.1400	ZC1
Total Floor Area	TFA	363.4400	
Assumed number of occupants	N	3.2144	

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		8.2799	ZC2
CO2 emissions from cooking, equation (L16)		0.5397	ZC3
Total CO2 emissions		14.9596	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		14.9596	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	169.0000 (1b)	x	2.6000 (2b)	=	439.4000	(1b) - (3b)
First floor	126.7500 (1c)	x	2.7000 (2c)	=	342.2250	(1c) - (3c)
Second floor	67.6900 (1d)	x	2.4100 (2d)	=	163.1329	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	363.4400					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	944.7579	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent 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)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0423	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.2923	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2923	(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	0.3727	0.3654	0.3581	0.3216	0.3143	0.2777	0.2777	0.2704	0.2923	0.3143	0.3289	0.3435	(22b)
Effective ac	0.5695	0.5668	0.5641	0.5517	0.5494	0.5386	0.5386	0.5366	0.5427	0.5494	0.5541	0.5590	(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			7.4100	1.0000	7.4100			(26)
TER Semi-glazed door			1.8900	1.2000	2.2680			(26a)
TER Opening Type (Uw = 1.40)			61.6800	1.3258	81.7727			(27)
TER Room Window (Uw = 1.70)			0.2700	1.5918	0.4298			(27a)
Heat Loss Floor 1			169.0000	0.1300	21.9700			(28a)
External Wall 1	278.6800	63.5500	215.1300	0.1800	38.7234			(29a)
Dormer wall	14.4900	5.5400	8.9500	0.1800	1.6110			(29a)
Stud wall	51.3500		51.3500	0.1800	9.2430			(29a)
Garage wall	18.7700	1.8900	16.8800	0.1800	3.0384			(29a)
Flat ceing roof	62.3000		62.3000	0.1300	8.0990			(30)
Dormer roof	8.2000		8.2000	0.1300	1.0660			(30)
Pitched roof	49.1100	0.2700	48.8400	0.1300	6.3492			(30)
Ceiling joists	59.0700		59.0700	0.1300	7.6791			(30)
Total net area of external elements Aum(A, m2)			710.9700					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		189.6596			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		21.5509	(36)
Total fabric heat loss	(33) + (36) =	211.2105	(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	177.5420	176.7011	175.8768	172.0050	171.2806	167.9084	167.9084	167.2839	169.2073	171.2806	172.7460	174.2781	(38)
Heat transfer coeff	388.7525	387.9116	387.0873	383.2155	382.4911	379.1189	379.1189	378.4944	380.4178	382.4911	383.9565	385.4886	(39)
Average = Sum(39)m / 12 =												383.2120	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0696	1.0673	1.0651	1.0544	1.0524	1.0431	1.0431	1.0414	1.0467	1.0524	1.0565	1.0607	(40)
HLP (average)												1.0544	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.2144	(42)
Average daily hot water use (litres/day)	110.5420	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	121.5963	117.1746	112.7529	108.3312	103.9095	99.4878	99.4878	103.9095	108.3312	112.7529	117.1746	121.5963	(44)
Energy conte	180.3237	157.7123	162.7450	141.8850	136.1420	117.4802	108.8627	124.9215	126.4135	147.3227	160.8143	174.6339	(45)
Energy content (annual)										Total = Sum(45)m =		1739.2568	(45)
Distribution loss (46)m = 0.15 x (45)m													
	27.0486	23.6568	24.4117	21.2827	20.4213	17.6220	16.3294	18.7382	18.9620	22.0984	24.1221	26.1951	(46)
Water storage loss:													
Store volume												300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.1127	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.1409	(55)
Total storage loss													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage													
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(62)
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	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(64)
								Total per year (kWh/year) = Sum(64)m =				2429.5638	(64)
Heat gains from water heating, kWh/month													
	106.8607	94.8034	101.0157	92.5668	92.1703	84.4522	83.0999	88.4395	87.4225	95.8879	98.8608	104.9688	(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	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	160.7201	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	46.6627	41.4454	33.7056	25.5173	19.0745	16.1035	17.4004	22.6177	30.3574	38.5457	44.9886	47.9596	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	507.8208	513.0904	499.8112	471.5414	435.8558	402.3163	379.9099	374.6403	387.9195	416.1894	451.8750	485.4144	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	39.0720	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	-128.5761	(71)
Water heating gains (Table 5)													
	143.6300	141.0765	135.7739	128.5650	123.8848	117.2948	111.6934	118.8702	121.4202	128.8815	137.3067	141.0871	(72)
Total internal gains													
	772.3295	769.8283	743.5067	699.8397	653.0311	609.9306	583.2198	590.3443	613.9132	657.8327	708.3862	748.6771	(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	1.6800	10.6334	0.6300	0.7000	0.7700	5.4595	(74)
Northeast	40.8700	11.2829	0.6300	0.7000	0.7700	140.9285	(75)
East	2.7000	19.6403	0.6300	0.7000	0.7700	16.2063	(76)
Southeast	1.0200	36.7938	0.6300	0.7000	0.7700	11.4696	(77)
Southwest	15.4100	36.7938	0.6300	0.7000	0.7700	173.2804	(79)
Southwest	0.2700	38.2331	0.6300	0.7000	1.0000	4.0972	(82)

Solar gains	351.4414	651.3868	1029.4187	1503.8857	1890.6245	1967.0121	1858.9764	1557.0920	1191.8348	757.3624	430.5999	294.4880	(83)
Total gains	1123.7709	1421.2150	1772.9254	2203.7255	2543.6556	2576.9427	2442.1962	2147.4363	1805.7480	1415.1951	1138.9861	1043.1652	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	64.9228	65.0635	65.2021	65.8608	65.9856	66.5725	66.5725	66.6823	66.3452	65.9856	65.7337	65.4725	
alpha	5.3282	5.3376	5.3468	5.3907	5.3990	5.4382	5.4382	5.4455	5.4230	5.3990	5.3822	5.3648	
util living area													
	0.9999	0.9997	0.9986	0.9904	0.9472	0.8182	0.6532	0.7447	0.9549	0.9976	0.9998	1.0000	(86)
MIT	19.5921	19.7342	19.9915	20.3545	20.6980	20.9162	20.9808	20.9626	20.7628	20.3249	19.8963	19.5728	(87)
Th 2	20.0257	20.0276	20.0295	20.0382	20.0399	20.0475	20.0475	20.0490	20.0446	20.0399	20.0366	20.0331	(88)
util rest of house													
	0.9999	0.9996	0.9980	0.9861	0.9220	0.7386	0.5267	0.6211	0.9222	0.9961	0.9997	0.9999	(89)
MIT 2	18.1091	18.3186	18.6964	19.2312	19.7144	19.9850	20.0396	20.0307	19.8146	19.1918	18.5625	18.0862	(90)
Living area fraction									fLA = Living area / (4) =			0.1222	(91)
MIT	18.2904	18.4916	18.8546	19.3684	19.8346	20.0988	20.1546	20.1446	19.9305	19.3302	18.7255	18.2678	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2904	18.4916	18.8546	19.3684	19.8346	20.0988	20.1546	20.1446	19.9305	19.3302	18.7255	18.2678	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9993	0.9969	0.9818	0.9151	0.7434	0.5418	0.6349	0.9169	0.9944	0.9995	0.9999	(94)
Useful gains	1123.5708	1420.2656	1767.3774	2163.5396	2327.7819	1915.8165	1323.2670	1363.4514	1655.6409	1407.2474	1138.4416	1043.0435	(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													
	5438.7864	5272.3267	4782.3216	4011.6689	3111.4138	2084.6934	1347.6093	1417.2984	2218.0190	3339.2419	4463.6729	5422.9874	(97)

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Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	3210.5204	2588.5850	2243.1184	1330.6531	583.0221	0.0000	0.0000	0.0000	0.0000	1437.4039	2394.1666	3258.6783	(98)
Space heating												17046.1478	(98)
Space heating per m2											(98) / (4) =	46.9022	(99)

8c. Space cooling requirement

Not applicable

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 %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												18231.1741	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	3210.5204	2588.5850	2243.1184	1330.6531	583.0221	0.0000	0.0000	0.0000	0.0000	1437.4039	2394.1666	3258.6783	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	3433.7117	2768.5401	2399.0572	1423.1584	623.5531	0.0000	0.0000	0.0000	0.0000	1537.3304	2560.6059	3485.2174	(211)
Water heating requirement													
	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													
	238.9525	210.6673	221.3738	198.6226	194.7708	174.2178	167.4915	183.5503	183.1511	205.9515	217.5518	233.2627	(64)
Efficiency of water heater												79.8000	(216)
(217)m	89.6671	89.5959	89.4230	88.9509	87.5600	79.8000	79.8000	79.8000	79.8000	89.0044	89.5004	89.6966	(217)
Fuel for water heating, kWh/month													
	266.4884	235.1306	247.5581	223.2945	222.4427	218.3180	209.8891	230.0130	229.5126	231.3949	243.0737	260.0575	(219)
Water heating fuel used												2817.1731	(219)
Annual totals kWh/year													
Space heating fuel - main system												18231.1741	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												824.0775	(232)
Total delivered energy for all uses												21947.4248	(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	18231.1741	0.2160	3937.9336	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2817.1731	0.2160	608.5094	(264)
Space and water heating			4546.4430	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	824.0775	0.5190	427.6962	(268)
Total CO2, kg/m2/year			5013.0642	(272)
Emissions per m2 for space and water heating			12.5095	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.1768	(272b)
Emissions per m2 for pumps and fans			0.1071	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.5095 * 1.55) + 1.1768 + 0.1071, rounded to 2 d.p.			20.6700	(273)