BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

Land adjacent to No. 63 Netherhall Gardens

Job number: S12134

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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 Newview Properties Limited and in support of the planning application for the development named as Land adjacent to No.63 Netherhall Gardens. The development is comprising the demolition of a garage and the construction of a new build two storey dwelling plus heated basement falling under the requirements of Camden council.

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

- National Planning Policy
- The London Plan
- The Camden Council Local Plan Policy CC1 Climate Change Mitigation.

The above policies require:

- A 19 per cent reduction in CO2 over Part L 2013
- A 20 per cent reduction in CO2 emissions from onsite renewable technology alone
- Comply with current Part L 2021 Building Regulations

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

- Thermal specification meeting and exceeding Part L 2021 notional U-values
- A design which limits air permeability, targeting 4
- A design which limits thermal bridging
- Energy saving building services including low energy lighting, heating controls, heat recovery ventilation
- Low carbon Internal Air Source Heat Pumps and Solar PV Panels

This results in a 53% CO2 reduction over Part L 2013 with a 26% CO2 reduction from onsite renewable technology alone.

2 Existing and Proposed Development

The development site is located on Land adjacent to No.63 Netherhall Gardens in London.

The development proposals are for the demolition of a garage and the construction of a new build two storey dwelling plus heated basement

The development proposals constitute a minor development.

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

Figure 2.1: Site Location and proposals

3 Planning Policy

National Planning Policy Framework 2023

The NPPF was updated in December 2023 to place greater emphasis on beauty, place-making, the environment, and sustainable development. The strengthened environmental objectives aim to protect and enhance the natural, built, and historic environment, and encourage effective land use, greater biodiversity, prudent use of natural resources, minimisation of waste and pollution, and adaptation to climate change alongside a move to a low carbon economy.

Local Planning Policy

The relevant Camden Council Local Planning Policy requirements are as follows.

The development should target:

- Policy CC1 Climate Change Mitigation
- A 19per cent reduction in CO2 over Part L 2013
- A 20 per cent reduction in CO2 emissions from onsite renewable technology alone
- Comply with current Part L 2021 Building Regulations

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	25.00	134	3,350

The **Total Baseline CO2 Emissions** for the development are shown to be 3,350 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

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

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

	Part L 2021 Limiting Parameters	Part L 2021 Notional Targets	Proposed Development
Walls	0.26	0.18	0.18
Ground Floor	0.18	0.13	0.11
Roof	0.16	0.11	0.11
Windows	1.60	1.20	1.2 G-value 0.40
Roof light	2.20	1.70	1.60
Doors	1.60	1.00	1.00
Air permeability	8.00	5.00	4.00

- 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 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: Internal Air Source Heat Pump
- Heating Controls: Comprising time & temperature zone control
- Ventilation: Natural ventilation with localised extract fans / Mechanical ventilation with heat recovery combined within the ASHP

Table 6.1: 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	25.00	134	3,350	N/A
Be Lean	17.86	134	2,393	**29%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 957 kg/year.

7 Low Carbon Technology Review & Recommendations

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

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

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

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

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

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

WIND TURBINES

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

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

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

GROUND SOURCE HEAT PUMP (GSHP)

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

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

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

AIR SOURCE HEAT PUMP (ASHP)

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

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

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

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

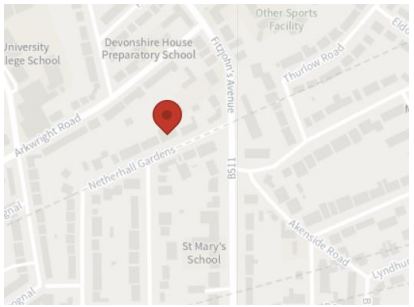
CHP is effectively an on-site small power plant providing both electrical power and thermal heat energy. It is an energy efficiency and low carbon measure rather than a renewable energy technology. A CHP system operates by burning a primary fuel (normally natural gas) by use of either a reciprocating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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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



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

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

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

SOLAR PHOTOVOLTAIC (PV)

Solar PV cells (which are mounted together in panels or tiles on the roof) convert sunlight into electricity. The cells are made from layers of semi-conducting material; when the light shines on the cell, an electric field is created across the layers. Although PV cells are most effective in bright sunlight, they can still generate electricity on a cloudy day. The power of a PV cell is measured in kilowatts peak (kWp). Each PV panel produces 250 Watts to 420 Watts depending on the manufacture.

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

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

SOLAR HOT WATER

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

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

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

Low Carbon Technology Summary

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

- **Internal Air Source Heat Pump with a winter efficiency 294.9% and summer efficiency 218%**
- **Solar PV to be displayed close to 30 degrees with modest shading. Totalling 1.6kWp southwest facing with an export cable.**

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

8 Low Carbon Technology – Renewable Energy Generation - Be Green

The internal ASHP and solar PV has been incorporated into the calculation and the results are set out below.

Table 8.1: Baseline vs Be Green CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	25.00	134	3,350	N/A
Lean & Green Design	11.77	134	1,577	**53%**

The **CO2 Emissions reduction** as a result of energy efficient fabric and services is shown to be 1,773 kg/year.

The table below shows the CO2 reduction through the incorporation of the onsite renewable technology in the form of 1.6kWp worth of solar PV.

Table 8.2: Be Green vs Be Green with solar PV added CO2

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Lean & Green Design with out solar PV	15.83	134	2,121	N/A
Lean & Green Design with solar PV	11.77	134	1,577	**26%**

The **CO2 Emissions reduction** as a result of on site renewable technology is shown to be 544 kg/year.

9 SAP 10 and Current Part L 2021 Building Regulations Compliance

To show compliance with current building regulations the Be Green development has been assessed using SAP 10 software. As the final construction has not been finalised the thermal bridging Y-value 0.050 has been used within the calculations. Due to this, when a full SAP assessment and the thermal junctions are assessed, results may vary.

The below table show the developments block compliance results.

Table 9.1 SAP 10 Developments Compliance - DER/TER Variance

	SAP 10 Calculation
Dwelling Emission Rate (DER) (kg CO2/m²/year)	3.69
Target Emission Rate (TER) (kg CO2/m²/year)	11.37
DER/TER Variance	-67%

Table 9.2 SAP 10 Developments Compliance – DFEE/TFEE variance

	SAP 10 Calculation
Dwelling Fabric Energy Efficiency (DFEE) (kW/m2/yr)	45.08
Target Fabric Energy Efficiency (TFEE) (kW/m2/yr)	45.12
DFEE/TFEE Variance	-0.09%

Table 9.3 SAP 10 Developments Compliance – DPER/TPER Variance

	SAP 10 Calculation
Dwelling Primary Energy Rate (DPER) (kW/m2/yr)	59.58
Target Primary Energy Rate (DPER) (kW/m2/yr)	40.31
DPER/TFER Variance	-60%

10 Conclusion

Proposals are for the development named as No.63 Netherhall Gardens. The development is comprising the demolition of a garage and the construction of a new build two storey dwelling plus heated basement falling under the requirements of Camden council.

Under the local planning policy the proposed development is required to:

- A 19 per cent reduction in CO2 over Part L 2013
- A 20 per cent reduction in CO2 emissions from onsite renewable technology alone

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 Solar PV totalling 1.6kWp and an internal Air Source Heat Pump with no outside condensing unit.

This results in a 53% CO2 reduction over Part L 2012 with a 26% CO2 reduction from onsite renewable technology alone.

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

11 Appendix 1 Be Lean DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	Be Lean	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	82 B	**DER**	17.86	**TER**	25.06
Environmental	83 B	**% DER<TER**	28.73		
CO_2 Emissions (t/year)	2.05	**DFEE**	49.26	**TFEE**	60.11
General Requirements Compliance	Fail	**% DFEE<TFEE**	18.05		

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 134 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) 25.06 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.86 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.60 (max. 3.30)	OK

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

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3 Air permeability
Air permeability at 50 pascals: 4.00 (design value)
Maximum 10.0 OK

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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 No cylinder

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

Hot water controls: No cylinder

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

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8 Mechanical ventilation
Continuous extract system
Specific fan power: 0.81
Maximum 0.7 Fail

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9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 10.16 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South: 3.51 m², No overhang
Windows facing North West: 3.76 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

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10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 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)	
Basement floor	45.5500 (1a)	x	2.5000 (2a)	=	113.8750	(1a) - (3a)
Ground floor	44.4300 (1b)	x	2.7500 (2b)	=	122.1825	(1b) - (3b)
First floor	44.4300 (1c)	x	2.9800 (2c)	=	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	368.4589	(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				4.0000	
Infiltration rate				0.2000	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)
Mechanical extract ventilation - centralised													
If mechanical ventilation:												0.5000	(23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
Roof light (Uw = 1.60)			7.0800	1.5038	10.6466			(27a)
Heat Loss Floor 1			45.5500	0.1000	4.5550			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1000	4.5690			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1000	0.0130			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		79.0149			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)							15.4205	(36)
Total fabric heat loss					(33) + (36) =		94.4354	(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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	(38)
Heat transfer coeff	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	(39)
Average = Sum(39)m / 12 =												155.2311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	(40)
HLP (average)												1.1549	(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	2.9056	(42)
Average daily hot water use (litres/day)	103.2077	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)											Total = Sum(45)m =	1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.6000	(49)
Enter (49) or (54) in (55)												1.2120	(55)
Total storage loss													
	37.5720	33.9360	37.5720	36.3600	37.5720	36.3600	37.5720	37.5720	36.3600	37.5720	36.3600	37.5720	(56)
If cylinder contains dedicated solar storage													
	37.5720	33.9360	37.5720	36.3600	37.5720	36.3600	37.5720	37.5720	36.3600	37.5720	36.3600	37.5720	(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													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(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													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(64)
											Total per year (kWh/year) = Sum(64)m =	2340.1354	(64)
Heat gains from water heating, kWh/month													
	74.5894	65.7690	69.1323	62.0562	60.8737	54.4800	52.4052	57.3904	57.2533	64.3446	67.9326	72.8231	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	100.2546	97.8706	92.9198	86.1892	81.8195	75.6667	70.4370	77.1377	79.5184	86.4847	94.3509	97.8805	(72)
Total internal gains													
	499.8714	497.6042	480.2409	451.8943	422.4970	394.6112	376.7665	383.3503	398.1436	426.7259	459.6197	484.8823	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342	(74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077	(77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606	(78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714	1102.0003	924.2927	709.8597	453.5051	259.1748	177.6811	(83)
Total gains	711.6604	888.4930	1094.5847	1345.5087	1543.6552	1560.3826	1478.7668	1307.6430	1108.0033	880.2310	718.7945	662.5633	(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	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	
alpha	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	
util living area													
	0.9989	0.9964	0.9859	0.9383	0.8045	0.6109	0.4566	0.5338	0.8191	0.9776	0.9973	0.9992	(86)
MIT	19.9607	20.1008	20.3324	20.6234	20.8401	20.9247	20.9418	20.9374	20.8602	20.5511	20.1914	19.9270	(87)
Th 2	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	(88)
util rest of house													
	0.9985	0.9951	0.9809	0.9169	0.7478	0.5220	0.3511	0.4189	0.7419	0.9663	0.9961	0.9989	(89)
MIT 2	18.5581	18.7626	19.0984	19.5068	19.7792	19.8639	19.8755	19.8736	19.8101	19.4154	18.8956	18.5088	(90)
Living area fraction											fLA = Living area / (4) =	0.2912	(91)
MIT	18.9665	19.1523	19.4577	19.8320	20.0882	20.1728	20.1860	20.1834	20.1159	19.7461	19.2729	18.9218	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9665	19.1523	19.4577	19.8320	20.0882	20.1728	20.1860	20.1834	20.1159	19.7461	19.2729	18.9218	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9938	0.9778	0.9139	0.7556	0.5411	0.3747	0.4446	0.7552	0.9633	0.9951	0.9986	(94)
Useful gains	710.2137	882.9597	1070.2722	1229.6219	1166.4134	844.3864	554.0476	581.3790	836.7764	847.8869	715.2663	661.6093	(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													
	2276.7014	2212.3972	2011.4441	1696.9833	1302.1061	865.0693	556.6565	587.2988	933.8531	1419.7569	1889.6152	2285.2811	(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)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating kWh

1165.4668	893.3820	700.2319	336.5002	100.9554	0.0000	0.0000	0.0000	0.0000	425.4713	845.5312	1208.0118	(98)

Space heating 5675.5506 (98)
Space heating per m2 (98) / (4) = 42.2257 (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 %) 249.9000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2271.1287 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1165.4668	893.3820	700.2319	336.5002	100.9554	0.0000	0.0000	0.0000	0.0000	425.4713	845.5312	1208.0118	(98)
Space heating efficiency (main heating system 1)													
	249.9000	249.9000	249.9000	249.9000	249.9000	0.0000	0.0000	0.0000	0.0000	249.9000	249.9000	249.9000	(210)
Space heating fuel (main heating system)													
	466.3733	357.4958	280.2048	134.6539	40.3983	0.0000	0.0000	0.0000	0.0000	170.2566	338.3478	483.3981	(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													
	229.1939	202.1955	212.7814	191.3431	187.9436	168.5576	162.4742	177.4675	176.8981	198.3825	209.0165	223.8816	(64)
Efficiency of water heater												175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month													
	130.8931	115.4743	121.5199	109.2765	107.3350	96.2636	92.7894	101.3521	101.0269	113.2967	119.3698	127.8593	(219)
Water heating fuel used												1336.4565	(219)
Annual totals kWh/year													
Space heating fuel - main system												2271.1287	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)
mechanical ventilation fans (SFP = 1.1340) 509.7555 (230a)
central heating pump 30.0000 (230c)
Total electricity for the above, kWh/year 539.7555 (231)
Electricity for lighting (calculated in Appendix L) 478.0997 (232)
Total delivered energy for all uses 4625.4405 (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	2271.1287	0.5190	1178.7158	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1336.4565	0.5190	693.6209	(264)
Space and water heating			1872.3367	(265)
Pumps and fans	539.7555	0.5190	280.1331	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/year			2400.6036	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.8600	(273)

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

DER		17.8600	ZC1
Total Floor Area	TFA	134.4100	
Assumed number of occupants	N	2.9056	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3568	ZC2
CO2 emissions from cooking, equation (L16)		1.4042	ZC3
Total CO2 emissions		32.6209	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		32.6209	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)	
Basement floor	45.5500	(1a)	x 2.5000	(2a) =	113.8750	(1a) - (3a)
Ground floor	44.4300	(1b)	x 2.7500	(2b) =	122.1825	(1b) - (3b)
First floor	44.4300	(1c)	x 2.9800	(2c) =	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		368.4589	(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) =	0.1086	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3586	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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			2.7600	1.0000	2.7600			(26)
TER Opening Type (Uw = 1.40)			19.8700	1.3258	26.3428			(27)
TER Room Window (Uw = 1.70)			7.0800	1.5918	11.2697			(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1300	5.9397			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1300	0.0169			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.9700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4244	(36)
Total fabric heat loss (33) + (36) =	97.3944	(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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Heat transfer coeff	169.0619	168.6397	168.2259	166.2823	165.9186	164.2258	164.2258	163.9123	164.8778	165.9186	166.6543	167.4234	(39)
Average = Sum(39)m / 12 =												166.2805	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2578	1.2547	1.2516	1.2371	1.2344	1.2218	1.2218	1.2195	1.2267	1.2344	1.2399	1.2456	(40)
HLP (average)												1.2371	(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	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:
Store volume 180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5520 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8381 (55)
Total storage loss

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)

If cylinder contains dedicated solar storage

	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (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

	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898 (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

	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898 (64)

Total per year (kWh/year) = Sum(64)m = 2203.6521 (64)

Heat gains from water heating, kWh/month

	95.3737	84.5419	89.9165	82.1700	81.6579	74.5938	73.1894	78.1747	77.3670	85.1289	88.0464	93.6073 (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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)

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

	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244 (67)

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

	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935 (68)

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

	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279 (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)

	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235 (71)

Water heating gains (Table 5)

	128.1904	125.8063	120.8555	114.1250	109.7553	103.6025	98.3728	105.0735	107.4542	114.4205	122.2867	125.8163 (72)

Total internal gains

	527.8072	525.5400	508.1767	479.8300	450.4328	422.5470	404.7023	411.2860	426.0794	454.6617	487.5554	512.8180 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.6300	0.7000	0.7700	33.0170	(74)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
South	3.5100	46.7521	0.6300	0.7000	0.7700	50.1510	(78)
Northwest	3.7600	11.2829	0.6300	0.7000	0.7700	12.9653	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431 (83)
Total gains	723.0640	887.2153	1079.2624	1313.5364	1498.1515	1512.4679	1434.8104	1274.3336	1087.0559	875.0407	726.7487	676.4611 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.2107	55.3489	55.4851	56.1336	56.2567	56.8366	56.8366	56.9453	56.6118	56.2567	56.0083	55.7510	
alpha	4.6807	4.6899	4.6990	4.7422	4.7504	4.7891	4.7891	4.7964	4.7741	4.7504	4.7339	4.7167	
util living area	0.9987	0.9964	0.9878	0.9497	0.8381	0.6527	0.4941	0.5712	0.8451	0.9800	0.9972	0.9991	(86)
MIT	19.5601	19.7445	20.0580	20.4741	20.8022	20.9559	20.9906	20.9820	20.8491	20.4027	19.9057	19.5325	(87)
Th 2	19.8740	19.8765	19.8790	19.8904	19.8926	19.9026	19.9026	19.9044	19.8987	19.8926	19.8882	19.8837	(88)
util rest of house	0.9983	0.9952	0.9833	0.9309	0.7837	0.5577	0.3758	0.4453	0.7699	0.9695	0.9959	0.9988	(89)
MIT 2	17.9558	18.2269	18.6838	19.2812	19.7058	19.8749	19.8993	19.8974	19.7784	19.1936	18.4711	17.9220	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	18.4230	18.6688	19.0839	19.6286	20.0251	20.1897	20.2171	20.2132	20.0902	19.5457	18.8888	18.3910	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4230	18.6688	19.0839	19.6286	20.0251	20.1897	20.2171	20.2132	20.0902	19.5457	18.8888	18.3910	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9932	0.9789	0.9254	0.7909	0.5838	0.4104	0.4821	0.7849	0.9650	0.9943	0.9981	(94)
Useful gains	721.1818	881.1731	1056.4549	1215.5230	1184.9577	883.0152	588.8907	614.4120	853.2699	844.3878	722.6024	675.1679	(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	2387.6624	2321.9667	2116.9440	1783.9692	1381.2858	917.9746	594.0211	625.0344	987.6476	1484.2590	1964.6608	2375.9040	(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	1239.8615	968.2133	789.0039	409.2813	146.0681	0.0000	0.0000	0.0000	0.0000	476.0642	894.2820	1265.3477	(98)
Space heating												6188.1220	(98)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 46.0391 (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												6618.3123	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1239.8615	968.2133	789.0039	409.2813	146.0681	0.0000	0.0000	0.0000	0.0000	476.0642	894.2820	1265.3477	(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)													
	1326.0551	1035.5222	843.8545	437.7340	156.2225	0.0000	0.0000	0.0000	0.0000	509.1596	956.4514	1353.3130	(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													
	217.6021	191.7255	201.1897	180.1253	176.3518	157.3398	150.8825	165.8758	165.6803	186.7907	197.7987	212.2898	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7238	88.5378	88.0998	86.9376	84.3163	79.8000	79.8000	79.8000	79.8000	87.2050	88.3543	88.7896	(217)
Fuel for water heating, kWh/month													
	245.2579	216.5466	228.3656	207.1893	209.1552	197.1676	189.0758	207.8644	207.6194	214.1973	223.8700	239.0932	(219)
Water heating fuel used												2585.4023	(219)
Annual totals kWh/year													
Space heating fuel - main system												6618.3123	(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)												478.0997	(232)
Total delivered energy for all uses												9756.8144	(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	6618.3123	0.2160	1429.5555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2585.4023	0.2160	558.4469	(264)
Space and water heating			1988.0024	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/m2/year			2275.0611	(272)
Emissions per m2 for space and water heating			14.7906	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8461	(272b)
Emissions per m2 for pumps and fans			0.2896	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7906 * 1.55) + 1.8461 + 0.2896, rounded to 2 d.p.			25.0600	(273)

12 Appendix 2 Be Green (no PV) DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	Be Green	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	84 B	**DER**	15.84	**TER**	25.00
Environmental	86 B	**% DER<TER**	36.64		
CO_2 Emissions (t/year)	1.77	**DFEE**	49.26	**TFEE**	60.11
General Requirements Compliance	Fail	**% DFEE<TFEE**	18.05		

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 134 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) 25.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.84 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.60 (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: 4.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
NIBE F730

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

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

Hot water controls: No cylinder

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

---
8 Mechanical ventilation
Continuous extract system
Specific fan power: 0.81
Maximum 0.7 Fail

---
9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 10.16 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South: 3.51 m², No overhang
Windows facing North West: 3.76 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 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)	
Basement floor	45.5500	(1a)	x 2.5000	(2a) =	113.8750	(1a) - (3a)
Ground floor	44.4300	(1b)	x 2.7500	(2b) =	122.1825	(1b) - (3b)
First floor	44.4300	(1c)	x 2.9800	(2c) =	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		368.4589	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised
If mechanical ventilation: 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
Roof light (Uw = 1.60)			7.0800	1.5038	10.6466			(27a)
Heat Loss Floor 1			45.5500	0.1000	4.5550			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1000	4.5690			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1000	0.0130			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.0149			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	15.4205	(36)
Total fabric heat loss (33) + (36) =	94.4354	(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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	(38)
Heat transfer coeff	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	(39)
Average = Sum(39)m / 12 =												155.2311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	(40)
HLP (average)												1.1549	(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	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0908	(55)
Total storage loss													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)
If cylinder contains dedicated solar storage													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(57)
Primary 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	(59)
Total heat required for water heating calculated for each month													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(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													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
								Total per year (kWh/year) = Sum(64)m =				2022.0014	(64)
Heat gains from water heating, kWh/month													
	55.9795	48.9601	50.5224	44.0466	42.2638	36.4704	33.7952	38.7805	39.2437	45.7347	49.9230	54.2132	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	75.2413	72.8572	67.9064	61.1759	56.8062	50.6534	45.4237	52.1244	54.5051	61.4714	69.3375	72.8672	(72)
Total internal gains													
	471.8581	469.5909	452.2276	423.8809	394.4837	366.5979	348.7532	355.3369	370.1302	398.7126	431.6063	456.8689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342	(74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077	(77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606	(78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714	1102.0003	924.2927	709.8597	453.5051	259.1748	177.6811	(83)
Total gains	683.6470	860.4796	1066.5714	1317.4954	1515.6419	1532.3693	1450.7535	1279.6296	1079.9899	852.2177	690.7811	634.5500	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	
alpha	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	
util living area													
	0.9991	0.9969	0.9874	0.9427	0.8127	0.6202	0.4650	0.5443	0.8301	0.9803	0.9977	0.9994	(86)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	20.3187	20.4094	20.5596	20.7496	20.8932	20.9504	20.9621	20.9590	20.9059	20.7013	20.4679	20.2969	
24 / 16	9	8	5	0	0	0	0	0	0	0	0	9	
24 / 9	22	20	14	0	0	0	0	0	0	0	0	22	
16 / 9	0	0	8	9	0	0	0	0	0	0	22	0	
MIT	21.0000	21.0000	20.8295	20.6665	20.8352	20.9238	20.9416	20.9368	20.8530	20.5390	20.4679	21.0000	(87)
Th 2	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	(88)
util rest of house													
	0.9987	0.9958	0.9828	0.9224	0.7568	0.5307	0.3578	0.4277	0.7546	0.9702	0.9968	0.9991	(89)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
MIT 2	19.9562	19.9562	19.6166	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	19.9562	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(93)

8. Space heating requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9961	0.9829	0.9195	0.7643	0.5500	0.3817	0.4538	0.7672	0.9672	0.9960	0.9992	(94)
Useful gains	682.8635	857.1356	1048.3117	1211.4634	1158.3624	842.7314	553.7955	580.7522	828.6171	824.3070	688.0051	634.0505	(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	2477.5176	2384.3789	2090.9349	1697.3681	1301.2742	864.9209	556.6336	587.2362	932.9344	1417.2087	1899.7965	2493.0407	(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	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating												6290.1169	(98)
Space heating per m2											(98) / (4) =	46.7980	(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)	0.0340	(201)
Fraction of space heat from main system(s)	0.9660	(202)
Efficiency of main space heating system 1 (in %)	276.6842	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	2196.0967	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating efficiency (main heating system 1)	276.6842	276.6842	276.6842	276.6842	276.6842	0.0000	0.0000	0.0000	0.0000	276.6842	276.6842	276.6842	(210)
Space heating fuel (main heating system)	466.1723	358.3193	270.8277	122.1452	37.1222	0.0000	0.0000	0.0000	0.0000	154.0098	304.6163	482.8840	(211)
Water heating requirement	45.3976	34.8945	26.3742	11.8949	3.6151	0.0000	0.0000	0.0000	0.0000	14.9980	29.6647	47.0250	(215)
Water heating													
Water heating requirement	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
Efficiency of water heater												207.1950	(216)
(217)m	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	(217)
Fuel for water heating, kWh/month	97.5768	85.8084	89.6556	79.7293	77.6679	68.7321	65.3754	72.6118	72.7576	82.7061	88.2591	95.0129	(219)
Water heating fuel used												975.8929	(219)
Annual totals kWh/year													
Space heating fuel - main system												2196.0967	(211)
Space heating fuel - secondary												213.8640	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)													
mechanical ventilation fans (SFP = 1.1340)												238.2225	(230a)
Total electricity for the above, kWh/year												238.2225	(231)
Electricity for lighting (calculated in Appendix L)												478.0997	(232)
Total delivered energy for all uses												4102.1758	(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	2196.0967	0.5190	1139.7742	(261)
Space heating - secondary	213.8640	0.5190	110.9954	(263)
Water heating (other fuel)	975.8929	0.5190	506.4884	(264)
Space and water heating			1757.2580	(265)
Pumps and fans	238.2225	0.5190	123.6375	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/year			2129.0293	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8400	(273)

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

DER		15.8400	ZC1
Total Floor Area	TFA	134.4100	
Assumed number of occupants	N	2.9056	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3568	ZC2
CO2 emissions from cooking, equation (L16)		1.4042	ZC3
Total CO2 emissions		30.6009	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		30.6009	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)	
Basement floor	45.5500	(1a)	x 2.5000	(2a) =	113.8750	(1a) - (3a)
Ground floor	44.4300	(1b)	x 2.7500	(2b) =	122.1825	(1b) - (3b)
First floor	44.4300	(1c)	x 2.9800	(2c) =	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		368.4589	(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) =	0.1086	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3586	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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			2.7600	1.0000	2.7600			(26)
TER Opening Type (Uw = 1.40)			19.8700	1.3258	26.3428			(27)
TER Room Window (Uw = 1.70)			7.0800	1.5918	11.2697			(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1300	5.9397			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1300	0.0169			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.9700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4244	(36)
Total fabric heat loss (33) + (36) =	97.3944	(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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Heat transfer coeff	169.0619	168.6397	168.2259	166.2823	165.9186	164.2258	164.2258	163.9123	164.8778	165.9186	166.6543	167.4234	(39)
Average = Sum(39)m / 12 =												166.2805	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2578	1.2547	1.2516	1.2371	1.2344	1.2218	1.2218	1.2195	1.2267	1.2344	1.2399	1.2456	(40)
HLP (average)												1.2371	(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	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(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													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
								Total per year (kWh/year) = Sum(64)m =				2172.4768	(64)
Heat gains from water heating, kWh/month													
	93.2554	82.6286	87.7983	80.1201	79.5397	72.5439	71.0712	76.0564	75.3172	83.0107	85.9965	91.4891	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	125.3433	122.9593	118.0085	111.2779	106.9082	100.7554	95.5257	102.2264	104.6072	111.5735	119.4396	122.9692	(72)
Total internal gains													
	524.9601	522.6929	505.3296	476.9830	447.5857	419.6999	401.8552	408.4390	423.2323	451.8147	484.7084	509.9710	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.6300	0.7000	0.7700	33.0170	(74)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
South	3.5100	46.7521	0.6300	0.7000	0.7700	50.1510	(78)
Northwest	3.7600	11.2829	0.6300	0.7000	0.7700	12.9653	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431	(83)
Total gains	720.2170	884.3682	1076.4153	1310.6894	1495.3045	1509.6208	1431.9633	1271.4865	1084.2088	872.1937	723.9016	673.6140	(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	55.2107	55.3489	55.4851	56.1336	56.2567	56.8366	56.8366	56.9453	56.6118	56.2567	56.0083	55.7510	
alpha	4.6807	4.6899	4.6990	4.7422	4.7504	4.7891	4.7891	4.7964	4.7741	4.7504	4.7339	4.7167	
util living area													
	0.9988	0.9965	0.9879	0.9501	0.8388	0.6537	0.4950	0.5723	0.8461	0.9803	0.9972	0.9991	(86)
MIT	19.5582	19.7426	20.0561	20.4726	20.8013	20.9557	20.9905	20.9819	20.8482	20.4009	19.9037	19.5305	(87)
Th 2	19.8740	19.8765	19.8790	19.8904	19.8926	19.9026	19.9026	19.9044	19.8987	19.8926	19.8882	19.8837	(88)
util rest of house													
	0.9983	0.9953	0.9835	0.9314	0.7845	0.5586	0.3765	0.4462	0.7711	0.9699	0.9960	0.9988	(89)
MIT 2	17.9530	18.2241	18.6811	19.2791	19.7049	19.8747	19.8993	19.8973	19.7775	19.1912	18.4683	17.9192	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9933	0.9791	0.9258	0.7918	0.5847	0.4112	0.4831	0.7861	0.9653	0.9944	0.9981	(94)
Useful gains	718.3720	878.4197	1053.8781	1213.5004	1183.9144	882.7490	588.8423	614.3051	852.2638	841.9699	719.8350	672.3485	(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													
	2387.2277	2321.5393	2116.5406	1783.6552	1381.1338	917.9391	594.0144	625.0200	987.5037	1483.8838	1964.2357	2375.4715	(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													
	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(98)
Space heating												6199.9446	(98)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating per m2 (98) / (4) = 46.1271 (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	6630.9568 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(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)	1327.9451	1037.1939	845.5839	439.0497	156.9318	0.0000	0.0000	0.0000	0.0000	510.7850	958.2552	1355.2123	(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	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7440	88.5603	88.1282	86.9786	84.3677	79.8000	79.8000	79.8000	79.8000	87.2447	88.3797	88.8095	(217)
Fuel for water heating, kWh/month	242.2186	213.7909	225.2877	204.1455	205.8894	193.9566	185.7578	204.5464	204.4085	211.0650	220.9062	236.0581	(219)
Water heating fuel used												2548.0306	(219)
Annual totals kWh/year													
Space heating fuel - main system												6630.9568	(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)												478.0997	(232)
Total delivered energy for all uses												9732.0872	(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	6630.9568	0.2160	1432.2867	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2548.0306	0.2160	550.3746	(264)
Space and water heating			1982.6613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/m2/year			2269.7201	(272)
Emissions per m2 for space and water heating			14.7508	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8461	(272b)
Emissions per m2 for pumps and fans			0.2896	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7508 * 1.55) + 1.8461 + 0.2896, rounded to 2 d.p.			25.0000	(273)

13 Appendix 3 Be Green DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	S12134 01	**Issued on Date**	02/05/2024
Assessment Reference	Be Green with PV	**Prop Type Ref**	
Property	63, Netherhall Gardens, London, NW3 5RE		

SAP Rating	89 B	**DER**	11.77	**TER**	25.00
Environmental	90 B	**% DER<TER**	52.92		
CO_2 Emissions (t/year)	1.20	**DFEE**	49.26	**TFEE**	60.11
General Requirements Compliance	Fail	**% DFEE<TFEE**	18.05		

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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DWELLING AS DESIGNED

Detached House, total floor area 134 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) 25.00 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.77 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.60 (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: 4.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
NIBE F730

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage No cylinder

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

Hot water controls: No cylinder

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

---
8 Mechanical ventilation
Continuous extract system
Specific fan power: 0.81
Maximum 0.7 Fail

---
9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 10.16 m², No overhang
Windows facing South East: 2.44 m², No overhang
Windows facing South: 3.51 m², No overhang
Windows facing North West: 3.76 m², No overhang
Air change rate: 2.50 ach
Blinds/curtains: None

---
10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 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)	
Basement floor	45.5500	(1a)	x 2.5000	(2a) =	113.8750	(1a) - (3a)
Ground floor	44.4300	(1b)	x 2.7500	(2b) =	122.1825	(1b) - (3b)
First floor	44.4300	(1c)	x 2.9800	(2c) =	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		368.4589	(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		4.0000	
Infiltration rate		0.2000	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1850	(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	0.2359	0.2313	0.2266	0.2035	0.1989	0.1758	0.1758	0.1711	0.1850	0.1989	0.2081	0.2174	(22b)

Mechanical extract ventilation - centralised
If mechanical ventilation: 0.5000 (23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) x Fmv (equation (N5)), otherwise (23b) = (23a) 0.5000 (23b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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	
Opening Type 1 (Uw = 1.20)			19.8700	1.1450	22.7519			(27)
Door			2.7600	1.0000	2.7600			(26)
Roof light (Uw = 1.60)			7.0800	1.5038	10.6466			(27a)
Heat Loss Floor 1			45.5500	0.1000	4.5550			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1000	4.5690			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1000	0.0130			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.0149			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	15.4205	(36)
Total fabric heat loss (33) + (36) =	94.4354	(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	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	60.7957	(38)
Heat transfer coeff	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	155.2311	(39)
Average = Sum(39)m / 12 =												155.2311	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	1.1549	(40)
HLP (average)												1.1549	(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	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)
Water storage loss:													
Store volume												180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.0200	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.0908	(55)
Total storage loss													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(56)
If cylinder contains dedicated solar storage													
	33.8148	30.5424	33.8148	32.7240	33.8148	32.7240	33.8148	33.8148	32.7240	33.8148	32.7240	33.8148	(57)
Primary 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	(59)
Total heat required for water heating calculated for each month													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(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													
	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
								Total per year (kWh/year) = Sum(64)m =				2022.0014	(64)
Heat gains from water heating, kWh/month													
	55.9795	48.9601	50.5224	44.0466	42.2638	36.4704	33.7952	38.7805	39.2437	45.7347	49.9230	54.2132	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	75.2413	72.8572	67.9064	61.1759	56.8062	50.6534	45.4237	52.1244	54.5051	61.4714	69.3375	72.8672	(72)
Total internal gains													
	471.8581	469.5909	452.2276	423.8809	394.4837	366.5979	348.7532	355.3369	370.1302	398.7126	431.6063	456.8689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.4500	0.0000	0.7700	37.4342	(74)
Southeast	2.4400	36.7938	0.4500	0.0000	0.7700	31.1077	(77)
South	3.5100	46.7521	0.4500	0.0000	0.7700	56.8606	(78)
Northwest	3.7600	11.2829	0.4500	0.0000	0.7700	14.6999	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	211.7890	390.8888	614.3439	893.6144	1121.1582	1165.7714	1102.0003	924.2927	709.8597	453.5051	259.1748	177.6811	(83)
Total gains	683.6470	860.4796	1066.5714	1317.4954	1515.6419	1532.3693	1450.7535	1279.6296	1079.9899	852.2177	690.7811	634.5500	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	60.1299	
alpha	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	5.0087	
util living area													
	0.9991	0.9969	0.9874	0.9427	0.8127	0.6202	0.4650	0.5443	0.8301	0.9803	0.9977	0.9994	(86)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	20.3187	20.4094	20.5596	20.7496	20.8932	20.9504	20.9621	20.9590	20.9059	20.7013	20.4679	20.2969	
24 / 16	9	8	5	0	0	0	0	0	0	0	0	9	
24 / 9	22	20	14	0	0	0	0	0	0	0	0	22	
16 / 9	0	0	8	9	0	0	0	0	0	0	22	0	
MIT	21.0000	21.0000	20.8295	20.6665	20.8352	20.9238	20.9416	20.9368	20.8530	20.5390	20.4679	21.0000	(87)
Th 2	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	19.9562	(88)
util rest of house													
	0.9987	0.9958	0.9828	0.9224	0.7568	0.5307	0.3578	0.4277	0.7546	0.9702	0.9968	0.9991	(89)
Tweekday	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
Tweekend	18.5368	18.7416	19.0789	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	18.4874	
MIT 2	19.9562	19.9562	19.6166	19.4926	19.7737	19.8629	19.8754	19.8733	19.8047	19.3972	18.8745	19.9562	(90)
Living area fraction									fLA = Living area / (4) =			0.2912	(91)
MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2602	20.2602	19.9698	19.8345	20.0828	20.1718	20.1858	20.1830	20.1100	19.7297	19.3385	20.2602	(93)

8. Space heating requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9961	0.9829	0.9195	0.7643	0.5500	0.3817	0.4538	0.7672	0.9672	0.9960	0.9992	(94)
Useful gains	682.8635	857.1356	1048.3117	1211.4634	1158.3624	842.7314	553.7955	580.7522	828.6171	824.3070	688.0051	634.0505	(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	2477.5176	2384.3789	2090.9349	1697.3681	1301.2742	864.9209	556.6336	587.2362	932.9344	1417.2087	1899.7965	2493.0407	(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	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating												6290.1169	(98)
Space heating per m2											(98) / (4) =	46.7980	(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)	0.0340	(201)
Fraction of space heat from main system(s)	0.9660	(202)
Efficiency of main space heating system 1 (in %)	276.6842	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	2196.0967	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1335.2226	1026.3075	775.7116	349.8514	106.3264	0.0000	0.0000	0.0000	0.0000	441.1188	872.4898	1383.0887	(98)
Space heating efficiency (main heating system 1)	276.6842	276.6842	276.6842	276.6842	276.6842	0.0000	0.0000	0.0000	0.0000	276.6842	276.6842	276.6842	(210)
Space heating fuel (main heating system)	466.1723	358.3193	270.8277	122.1452	37.1222	0.0000	0.0000	0.0000	0.0000	154.0098	304.6163	482.8840	(211)
Water heating requirement	45.3976	34.8945	26.3742	11.8949	3.6151	0.0000	0.0000	0.0000	0.0000	14.9980	29.6647	47.0250	(215)
Water heating													
Water heating requirement	202.1743	177.7907	185.7618	165.1951	160.9240	142.4096	135.4546	150.4479	150.7501	171.3629	182.8685	196.8620	(64)
Efficiency of water heater												207.1950	(216)
(217)m	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	207.1950	(217)
Fuel for water heating, kWh/month	97.5768	85.8084	89.6556	79.7293	77.6679	68.7321	65.3754	72.6118	72.7576	82.7061	88.2591	95.0129	(219)
Water heating fuel used												975.8929	(219)
Annual totals kWh/year													
Space heating fuel - main system												2196.0967	(211)
Space heating fuel - secondary												213.8640	(215)
Electricity for pumps and fans:													
(MEVCentralised, Database: in-use factor = 1.4000, SFP = 1.1340)													
mechanical ventilation fans (SFP = 1.1340)												238.2225	(230a)
Total electricity for the above, kWh/year												238.2225	(231)
Electricity for lighting (calculated in Appendix L)												478.0997	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.60 * 1029 * 0.80) =												-1053.8872	(233)
Total delivered energy for all uses												3048.2886	(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	2196.0967	0.5190	1139.7742	(261)
Space heating - secondary	213.8640	0.5190	110.9954	(263)
Water heating (other fuel)	975.8929	0.5190	506.4884	(264)
Space and water heating			1757.2580	(265)
Pumps and fans	238.2225	0.5190	123.6375	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Energy saving/generation technologies				
PV Unit	-1053.8872	0.5190	-546.9675	(269)
Total CO2, kg/year			1582.0618	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.7700	(273)

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

DER		11.7700	ZC1
Total Floor Area	TFA	134.4100	
Assumed number of occupants	N	2.9056	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.3568	ZC2
CO2 emissions from cooking, equation (L16)		1.4042	ZC3
Total CO2 emissions		26.5309	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		26.5309	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)	
Basement floor	45.5500	(1a)	x 2.5000	(2a) =	113.8750	(1a) - (3a)
Ground floor	44.4300	(1b)	x 2.7500	(2b) =	122.1825	(1b) - (3b)
First floor	44.4300	(1c)	x 2.9800	(2c) =	132.4014	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	134.4100					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		368.4589	(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) =	0.1086	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3586	(18)
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.3317	(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	0.4229	0.4146	0.4063	0.3648	0.3565	0.3151	0.3151	0.3068	0.3317	0.3565	0.3731	0.3897	(22b)
Effective ac	0.5894	0.5859	0.5825	0.5666	0.5636	0.5496	0.5496	0.5471	0.5550	0.5636	0.5696	0.5759	(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			2.7600	1.0000	2.7600			(26)
TER Opening Type (Uw = 1.40)			19.8700	1.3258	26.3428			(27)
TER Room Window (Uw = 1.70)			7.0800	1.5918	11.2697			(27a)
Heat Loss Floor 1			45.5500	0.1300	5.9215			(28a)
External Wall 1	141.1700	7.8000	133.3700	0.1800	24.0066			(29a)
Basement wall	68.7900	14.8300	53.9600	0.1800	9.7128			(29a)
Pitched roof	51.7700	6.0800	45.6900	0.1300	5.9397			(30)
Flat roof (glazing)	1.1300	1.0000	0.1300	0.1300	0.0169			(30)
Total net area of external elements Aum(A, m2)			308.4100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.9700			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.4244	(36)
Total fabric heat loss (33) + (36) =	97.3944	(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	71.6675	71.2453	70.8315	68.8879	68.5243	66.8314	66.8314	66.5179	67.4835	68.5243	69.2599	70.0290	(38)
Heat transfer coeff	169.0619	168.6397	168.2259	166.2823	165.9186	164.2258	164.2258	163.9123	164.8778	165.9186	166.6543	167.4234	(39)
Average = Sum(39)m / 12 =												166.2805	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2578	1.2547	1.2516	1.2371	1.2344	1.2218	1.2218	1.2195	1.2267	1.2344	1.2399	1.2456	(40)
HLP (average)												1.2371	(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	2.9056 (42)
Average daily hot water use (litres/day)	103.2077 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.5285	109.4002	105.2719	101.1436	97.0153	92.8870	92.8870	97.0153	101.1436	105.2719	109.4002	113.5285	(44)
Energy conte	168.3595	147.2483	151.9470	132.4711	127.1092	109.6856	101.6398	116.6331	118.0261	137.5481	150.1445	163.0472	(45)
Energy content (annual)										Total = Sum(45)m =		1623.8594	(45)
Distribution loss (46)m = 0.15 x (45)m	25.2539	22.0872	22.7921	19.8707	19.0664	16.4528	15.2460	17.4950	17.7039	20.6322	22.5217	24.4571	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(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													
	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
								Total per year (kWh/year) = Sum(64)m =				2172.4768	(64)
Heat gains from water heating, kWh/month													
	93.2554	82.6286	87.7983	80.1201	79.5397	72.5439	71.0712	76.0564	75.3172	83.0107	85.9965	91.4891	(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	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	145.2794	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.0720	24.0451	19.5548	14.8042	11.0663	9.3427	10.0951	13.1220	17.6123	22.3628	26.1007	27.8244	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	302.9610	306.1047	298.1825	281.3170	260.0273	240.0180	226.6506	223.5068	231.4290	248.2945	269.5842	289.5935	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	37.5279	(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)													
	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	-116.2235	(71)
Water heating gains (Table 5)													
	125.3433	122.9593	118.0085	111.2779	106.9082	100.7554	95.5257	102.2264	104.6072	111.5735	119.4396	122.9692	(72)
Total internal gains													
	524.9601	522.6929	505.3296	476.9830	447.5857	419.6999	401.8552	408.4390	423.2323	451.8147	484.7084	509.9710	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	10.1600	10.6334	0.6300	0.7000	0.7700	33.0170	(74)
Southeast	2.4400	36.7938	0.6300	0.7000	0.7700	27.4370	(77)
South	3.5100	46.7521	0.6300	0.7000	0.7700	50.1510	(78)
Northwest	3.7600	11.2829	0.6300	0.7000	0.7700	12.9653	(81)
Northeast	3.7200	18.0708	0.6300	0.7000	1.0000	26.6810	(82)
Southwest	2.3600	37.0308	0.6300	0.7000	1.0000	34.6862	(82)
Horizontal	1.0000	26.0000	0.6300	0.7000	1.0000	10.3194	(82)

Solar gains	195.2569	361.6753	571.0857	833.7064	1047.7188	1089.9208	1030.1081	863.0475	660.9765	420.3790	239.1933	163.6431	(83)
Total gains	720.2170	884.3682	1076.4153	1310.6894	1495.3045	1509.6208	1431.9633	1271.4865	1084.2088	872.1937	723.9016	673.6140	(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	55.2107	55.3489	55.4851	56.1336	56.2567	56.8366	56.8366	56.9453	56.6118	56.2567	56.0083	55.7510	
alpha	4.6807	4.6899	4.6990	4.7422	4.7504	4.7891	4.7891	4.7964	4.7741	4.7504	4.7339	4.7167	
util living area													
	0.9988	0.9965	0.9879	0.9501	0.8388	0.6537	0.4950	0.5723	0.8461	0.9803	0.9972	0.9991	(86)
MIT	19.5582	19.7426	20.0561	20.4726	20.8013	20.9557	20.9905	20.9819	20.8482	20.4009	19.9037	19.5305	(87)
Th 2	19.8740	19.8765	19.8790	19.8904	19.8926	19.9026	19.9026	19.9044	19.8987	19.8926	19.8882	19.8837	(88)
util rest of house													
	0.9983	0.9953	0.9835	0.9314	0.7845	0.5586	0.3765	0.4462	0.7711	0.9699	0.9960	0.9988	(89)
MIT 2	17.9530	18.2241	18.6811	19.2791	19.7049	19.8747	19.8993	19.8973	19.7775	19.1912	18.4683	17.9192	(90)
Living area fraction										fLA = Living area / (4) =		0.2912	(91)
MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4204	18.6663	19.0815	19.6267	20.0242	20.1895	20.2171	20.2131	20.0893	19.5434	18.8863	18.3884	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9933	0.9791	0.9258	0.7918	0.5847	0.4112	0.4831	0.7861	0.9653	0.9944	0.9981	(94)
Useful gains	718.3720	878.4197	1053.8781	1213.5004	1183.9144	882.7490	588.8423	614.3051	852.2638	841.9699	719.8350	672.3485	(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													
	2387.2277	2321.5393	2116.5406	1783.6552	1381.1338	917.9391	594.0144	625.0200	987.5037	1483.8838	1964.2357	2375.4715	(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													
	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(98)
Space heating												6199.9446	(98)

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Space heating per m2 (98) / (4) = 46.1271 (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	6630.9568 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1241.6286	969.7763	790.6209	410.5114	146.7312	0.0000	0.0000	0.0000	0.0000	477.5840	895.9686	1267.1235	(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)	1327.9451	1037.1939	845.5839	439.0497	156.9318	0.0000	0.0000	0.0000	0.0000	510.7850	958.2552	1355.2123	(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	214.9544	189.3340	198.5419	177.5629	173.7041	154.7774	148.2347	163.2280	163.1180	184.1430	195.2363	209.6421	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7440	88.5603	88.1282	86.9786	84.3677	79.8000	79.8000	79.8000	79.8000	87.2447	88.3797	88.8095	(217)
Fuel for water heating, kWh/month	242.2186	213.7909	225.2877	204.1455	205.8894	193.9566	185.7578	204.5464	204.4085	211.0650	220.9062	236.0581	(219)
Water heating fuel used												2548.0306	(219)
Annual totals kWh/year													
Space heating fuel - main system												6630.9568	(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)												478.0997	(232)
Total delivered energy for all uses												9732.0872	(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	6630.9568	0.2160	1432.2867	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2548.0306	0.2160	550.3746	(264)
Space and water heating			1982.6613	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	478.0997	0.5190	248.1338	(268)
Total CO2, kg/m2/year			2269.7201	(272)
Emissions per m2 for space and water heating			14.7508	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8461	(272b)
Emissions per m2 for pumps and fans			0.2896	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7508 * 1.55) + 1.8461 + 0.2896, rounded to 2 d.p.			25.0000	(273)