BASEENERGY
Building Assessments for a Sustainable Environment

Energy Statement

58 Grenoble Gardens, London, N13 6JG

Job number: S11674

Date: December 2023

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

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

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

Revision	Issue Date	Author	Checked	Description
0	06/12/2023	NG	PK	First Issue

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

Contents

1 Executive Summary

This report has been produced by Base Energy on behalf of Sadiq Saleh and in support of the planning application for the development named as 58 Grenoble Gardens comprising the conversion of an existing single-family dwelling to create 2 x residential apartments falling under the requirements of Enfield 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 Enfield Local Planning Policy CP20 Sustainable Energy Use and Energy Infrastructure.

The above policies require:

- A 35 per cent reduction in CO2 over Part L 2013

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

- Thermal specification exceeding Part L 2013 notional U-values
- Energy saving building services including low energy lighting and heating controls
- Air Source Heat Pump

This results in a 19.6% CO2 reduction over Part L1B 2013 and 60% CO2 reduction using the GLA spreadsheet and SAP10 carbon factors.

2 Existing and Proposed Development

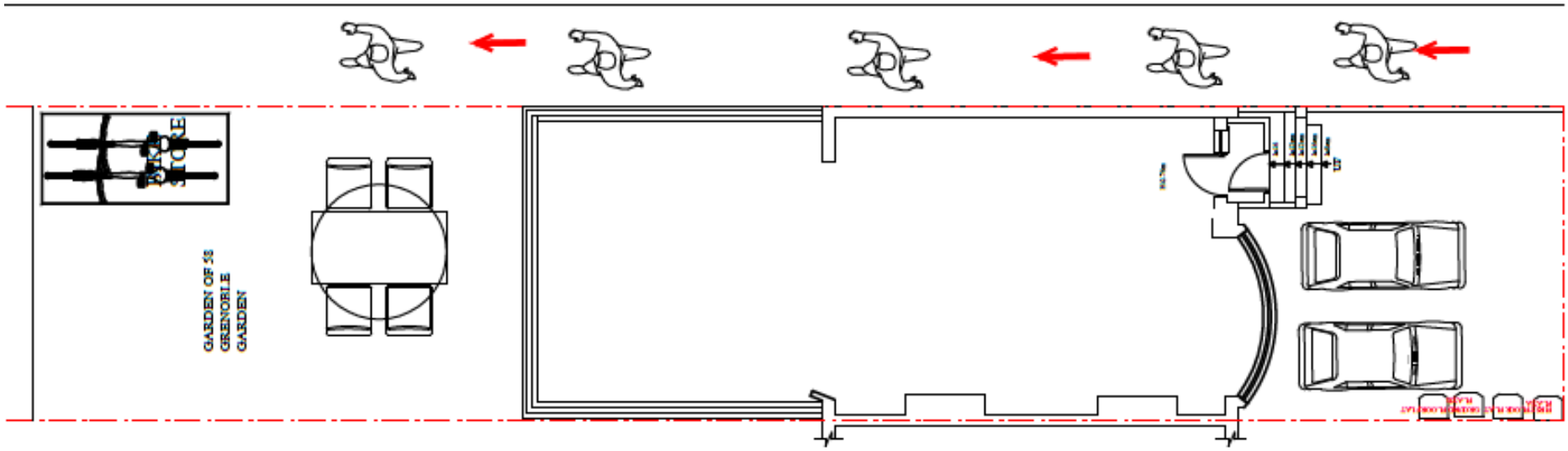
The development site is located on land at 58 Grenoble Gardens, London, N13 6JG.

The development proposals are for the conversion of an existing single-family dwelling to create 2 x residential apartments.

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: Proposed Block Plan



3 Planning Policy

National Planning Policy Framework 2021

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

Local Planning Policy

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

The development should target:

- Planning Policy CP20 Sustainable Energy Use and Energy Infrastructure.
- A 35 per cent reduction in CO2 over Part L 2013
- The London Plan guidance stated that the CO2 emissions should be made in SAP 2012 software and the GLA Carbon Emission Reporting Spreadsheet used to convert results to SAP 10 carbon factors.
- A 35% CO2 reduction using SAP 10 Carbon Factors for the GLA spreadsheet

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 over Part L1B 2013

	CO2 Emission Rate (kg CO2/m2/year)	Approximate Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	26.57	163.25	4,338

The Total Baseline CO2 Emissions for the development are shown to be 1,988 kg/year.

Table 5.2: Baseline Results using Sap 10 Carbon Factors for GLA Spreadsheet

SAP 10	CO2 Emission Rate (kg CO2/m2/year)	Approximate Floor Area (m2)	Total Baseline Emissions (kg CO2/year)
Baseline	24.3	163.25	3,964

The **Total Baseline CO2 Emissions** when calculated in **SAP 10** are shown to be 3,964 kg/year.

6 Low Carbon Design – Fabric First – Be Lean

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

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

	Part L 2013 Notional Targets	Part L 2021 Notional Targets	Proposed Development
External Walls	0.30	0.30	0.25
New Ground Floor	0.22	0.22	0.12
Pitched Roof	0.18	0.15	0.14
Flat Roof & Ceiling joists	0.16	0.15	0.14
Windows	1.60	1.4	1.40
Doors	1.60	1.4	1.40

- Insulation: The specified building envelope is designed to meet the notional Part L 2021 targets and will help to limit the energy demand of the dwelling for space heating

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

- Lighting: Low energy LED lighting throughout with a minimum efficacy of 80 lumens per watt
- Space & Water Heating: Condensing gas combi boiler
- Heating Controls: Comprising delayed start, programmer, thermostat, and TRVs
- Ventilation: Natural ventilation with localised extract fans

The specifications outlined above, and with the heating provided by a gas system as required by the GLA guidance, have been incorporated into the calculation to generate a dwelling emission rate to be measured against the baseline data.

Table 6.1: Baseline vs Be Lean CO2 Part L1B 2013

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	26.57	163.25	4,338	N/A
Be Lean	24.23	163.25	3,957	8.8%

The CO2 Emissions reduction as a result of energy efficient fabric and services is shown to be 381 kg/year.

Table 6.2: Baseline vs Be Lean using SAP 10 Carbon Factors for GLA Spreadsheet

SAP 10	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2 Using SAP 10 Factors
Baseline	24.3	163.25	3,964	N/A
Be Lean	22.4	163.25	3,654	7.8%

The CO2 Emissions reduction when calculated in SAP 10 is shown to be 310 kg/year.

7 Low Carbon Technology Review & Recommendations

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

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

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

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

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

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

WIND TURBINES

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

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

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

GROUND SOURCE HEAT PUMP (GSHP)

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

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

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

AIR SOURCE HEAT PUMP (ASHP)

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

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

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

BIOMASS

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

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

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

COMBINED HEAT AND POWER (CHP)

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

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

CHP **is not recommended** for this development

DISTRICT HEATING

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

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

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

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

SOLAR PHOTOVOLTAIC (PV)

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

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

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

SOLAR HOT WATER

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

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

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

Low Carbon Technology Summary

The low carbon technology review indicates that an Air Source Heat Pump and Solar PV would be potentially feasible. The following low carbon technology is recommended and preferred by the client:

MCS Certified Air Source Heat Pump.

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

8 Low Carbon Technology – Renewable Energy Generation - Be Green

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

Table 8.1: Baseline vs Be Lean CO2 Part L1B 2013

	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2
Baseline	26.57	163.25	4,338	N/A
Be Green Design	21.36	163.25	3,487	19.61%

The CO2 Emissions reduction as a result of energy efficient fabric and services is shown to be 851 kg/year.

Table 8.3: Baseline Results – SAP 10 for carbon reporting spreadsheet

SAP 10	CO2 Emission Rate (kg CO2/m2/year)	Floor Area (m2)	Total Baseline Emissions (kg CO2/year)	Reduction in CO2 Using SAP 10 Factors
Baseline	24.3	163.25	3,964	N/A
Be Green Design	9.7	163.25	1,580	60%

The Total Baseline CO2 Emissions when calculated in SAP 10 are shown to be 1,580 kg/year.

When compared to the Baseline scenario of 3,964 kg/year, this shows an overall 60% reduction in CO2 emissions over Part L 2013 using the SAP 10 carbon GLA spreadsheet.

9 Conclusion

This report has been produced by Base Energy on behalf of Sadiq Saleh and in support of the planning application for the development named as 58 Grenoble Gardens comprising the conversion of an existing single-family dwelling to create 2 x residential apartments falling under the requirements of Enfield Council.

Under the Enfield local planning policy the proposed development is required to achieve 35% CO2 reduction over Part L1B 2013

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 of an MCS Certified Air Source Heat Pump.

This results in a 19.6% CO2 reduction over Part L1B 2013 and 60% CO2 reduction using the GLA spreadsheet and SAP10 carbon factors.

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

10 Appendix 1 Sample Notional DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	1. Baseline/Notional	**Issued on Date**	06/12/2023
Assessment Reference	Flat A	**Prop Type Ref**	
Property	58, Grenoble Gardens, London, N13 6JG		

SAP Rating	78 C	**DER**	28.18	**TER**	17.97
Environmental	78 C	**% DER<TER**	-56.83		
CO_2 Emissions (t/year)	1.71	**DFEE**	80.83	**TFEE**	50.20
General Requirements Compliance	Fail	**% DFEE<TFEE**	-61.01		

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

---

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

---

DWELLING AS DESIGNED

Ground-floor flat, total floor area 78 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:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.97 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 28.18 kgCO□/m²Fail
Excess emissions =10.21 kgCO□/m² (56.8%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)80.8 kWh/m²/yrFail
Excess energy =30.6 kWh/m²/yr (61.0%)

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.30 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	OK
Roof	0.16 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.60 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

---

3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
Manufacturer Manufacturer
Combi boiler
Efficiency: 88%
Minimum: 88% OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage: No cylinder

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---

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

---

8 Mechanical ventilation
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 5.95 m², No overhang
Windows facing South: 7.78 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value: 0.00 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)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7569	(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	0.9651	0.9461	0.9272	0.8326	0.8137	0.7191	0.7191	0.7001	0.7569	0.8137	0.8515	0.8894	(22b)
Effective ac	0.9657	0.9476	0.9299	0.8466	0.8310	0.7585	0.7585	0.7451	0.7865	0.8310	0.8626	0.8955	(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	
Windows (Uw = 1.60)			13.7300	1.5038	20.6466			(27)
Rooflights (Uw = 1.60)			3.1000	1.5038	4.6617			(27a)
GF			77.6500	0.2200	17.0830			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.3000	13.4910			(29a)
Flat	32.1000	3.1000	29.0000	0.1600	4.6400			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	60.5223			(33)
Party Wall 1			52.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.2675	(36)
Total fabric heat loss (33) + (36) =	85.7898	(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	68.0489	66.7746	65.5256	59.6590	58.5614	53.4517	53.4517	52.5055	55.4199	58.5614	60.7818	63.1033	(38)
Heat transfer coeff	153.8386	152.5644	151.3154	145.4488	144.3511	139.2415	139.2415	138.2953	141.2097	144.3511	146.5716	148.8930	(39)
Average = Sum(39)m / 12 =												145.4435	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.9812	1.9648	1.9487	1.8731	1.8590	1.7932	1.7932	1.7810	1.8185	1.8590	1.8876	1.9175	(40)
HLP (average)												1.8731	(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	2.4168 (42)
Average daily hot water use (litres/day)	91.5980 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.6898	47.6109	44.2682	43.8767	40.6545	42.0096	43.8767	44.2682	47.6109	47.8819	50.9589	(61)
Total heat required for water heating calculated for each month													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
								Total per year (kWh/year) = Sum(64)m =				1989.8589	(64)
Heat gains from water heating, kWh/month													
	62.4222	54.6251	56.7419	50.1589	48.4788	42.5316	40.4961	45.3873	45.8963	52.4928	56.2777	60.8545	(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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.8957	21.2239	17.2605	13.0673	9.7680	8.2465	8.9107	11.5824	15.5459	19.7391	23.0384	24.5598	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	(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)													
	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	(71)
Water heating gains (Table 5)													
	83.9008	81.2873	76.2660	69.6652	65.1597	59.0716	54.4302	61.0045	63.7448	70.5549	78.1635	81.7937	(72)
Total internal gains													
	384.5069	381.4471	366.8544	344.1217	321.2463	299.4727	286.0329	293.0535	305.3653	328.3073	354.2857	373.6015	(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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107	(83)
Total gains	546.9937	666.8927	779.6648	891.6376	966.4695	953.8420	911.1849	843.3627	764.6041	649.8602	550.5054	511.6122	(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	35.0521	35.3448	35.6366	37.0740	37.3559	38.7267	38.7267	38.9917	38.1869	37.3559	36.7899	36.2163	
alpha	3.3368	3.3563	3.3758	3.4716	3.4904	3.5818	3.5818	3.5994	3.5458	3.4904	3.4527	3.4144	
util living area													
	0.9955	0.9908	0.9802	0.9511	0.8847	0.7544	0.6089	0.6619	0.8635	0.9688	0.9920	0.9965	(86)
MIT	18.8733	19.1090	19.4902	20.0254	20.4779	20.8143	20.9374	20.9154	20.6613	20.0663	19.4100	18.8866	(87)
Th 2	19.3459	19.3569	19.3678	19.4193	19.4290	19.4748	19.4748	19.4833	19.4571	19.4290	19.4093	19.3889	(88)
util rest of house													
	0.9938	0.9873	0.9722	0.9297	0.8295	0.6348	0.4261	0.4832	0.7758	0.9509	0.9884	0.9952	(89)
MIT 2	17.4855	17.7275	18.1122	18.6700	19.0926	19.3954	19.4617	19.4628	19.2810	18.7258	18.0658	17.5294	(90)
Living area fraction										fLA = Living area / (4) =		0.2853	(91)
MIT	17.8814	18.1216	18.5053	19.0567	19.4878	19.8002	19.8827	19.8772	19.6748	19.1082	18.4492	17.9165	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8814	18.1216	18.5053	19.0567	19.4878	19.8002	19.8827	19.8772	19.6748	19.1082	18.4492	17.9165	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9915	0.9836	0.9663	0.9233	0.8320	0.6641	0.4796	0.5351	0.7912	0.9458	0.9852	0.9933	(94)
Useful gains	542.3662	655.9297	753.4122	823.2294	804.1209	633.4436	436.9811	451.2817	604.9830	614.6629	542.3538	508.2081	(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													
	2089.3411	2017.1389	1816.5873	1477.2743	1124.1741	724.0776	457.0815	480.8751	787.2103	1228.1619	1663.4748	2042.2972	(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													
	1150.9493	914.7326	791.0023	470.9123	238.1196	0.0000	0.0000	0.0000	0.0000	456.4432	807.2071	1141.3622	(98)
Space heating												5970.7287	(98)
Space heating per m2											(98) / (4) =	76.8928	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)												88.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6784.9190	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1150.9493	914.7326	791.0023	470.9123	238.1196	0.0000	0.0000	0.0000	0.0000	456.4432	807.2071	1141.3622	(98)
Space heating efficiency (main heating system 1)													
	88.0000	88.0000	88.0000	88.0000	88.0000	0.0000	0.0000	0.0000	0.0000	88.0000	88.0000	88.0000	(210)
Space heating fuel (main heating system)													
	1307.8969	1039.4688	898.8663	535.1276	270.5905	0.0000	0.0000	0.0000	0.0000	518.6855	917.2808	1297.0025	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
Efficiency of water heater												88.0000	(216)
(217)m	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	(217)
Fuel for water heating, kWh/month													
	227.7044	199.2890	207.3473	183.9066	178.0540	156.8201	150.2456	167.4886	169.3383	192.8254	205.8373	222.3467	(219)
Water heating fuel used												2261.2033	(219)
Annual totals kWh/year													
Space heating fuel - main system												6784.9190	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												422.0055	(232)
Total delivered energy for all uses												9498.1279	(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	6784.9190	0.2160	1465.5425	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2261.2033	0.2160	488.4199	(264)
Space and water heating			1953.9624	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	422.0055	0.5190	219.0209	(268)
Total CO2, kg/year			2188.5533	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			28.1800	(273)

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

DER		28.1800	ZC1
Total Floor Area	TFA	77.6500	
Assumed number of occupants	N	2.4168	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3662	ZC2
CO2 emissions from cooking, equation (L16)		2.2795	ZC3
Total CO2 emissions		46.8257	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		46.8257	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3319	(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	0.4232	0.4149	0.4066	0.3651	0.3568	0.3153	0.3153	0.3070	0.3319	0.3568	0.3734	0.3900	(22b)
Effective ac	0.5895	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5471	0.5551	0.5637	0.5697	0.5761	(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 Opening Type (Uw = 1.40)			13.7300	1.3258	18.2027			(27)
TER Room Window (Uw = 1.70)			3.1000	1.5918	4.9345			(27a)
GF			77.6500	0.1300	10.0945			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.1800	8.0946			(29a)
Flat	32.1000	3.1000	29.0000	0.1300	3.7700			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0962			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	8.4225	(36)
Total fabric heat loss (33) + (36) =	53.5187	(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	41.5438	41.2988	41.0586	39.9305	39.7194	38.7369	38.7369	38.5549	39.1153	39.7194	40.1464	40.5928	(38)
Heat transfer coeff	95.0625	94.8175	94.5773	93.4492	93.2381	92.2556	92.2556	92.0736	92.6341	93.2381	93.6651	94.1115	(39)
Average = Sum(39)m / 12 =												93.4482	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2211	1.2180	1.2035	1.2007	1.1881	1.1881	1.1858	1.1930	1.2007	1.2062	1.2120	(40)
HLP (average)												1.2035	(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	2.4168	(42)
Average daily hot water use (litres/day)	91.5980	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	44.6898	47.6109	44.2682	43.8767	40.6545	42.0096	43.8767	44.2682	47.6109	47.8819	50.9589	(61)
Total heat required for water heating calculated for each month													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
									Total per year (kWh/year) = Sum(64)m =			1989.8589	(64)
Heat gains from water heating, kWh/month													
	62.4222	54.6251	56.7419	50.1589	48.4788	42.5316	40.4961	45.3873	45.8963	52.4928	56.2777	60.8545	(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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.1166	16.9792	13.8084	10.4538	7.8144	6.5972	7.1285	9.2659	12.4367	15.7913	18.4307	19.6479	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	(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)													
	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	(71)
Water heating gains (Table 5)													
	83.9008	81.2873	76.2660	69.6652	65.1597	59.0716	54.4302	61.0045	63.7448	70.5549	78.1635	81.7937	(72)
Total internal gains													
	379.7278	377.2023	363.4023	341.5082	319.2927	297.8234	284.2508	290.7371	302.2561	324.3595	349.6781	368.6895	(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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107	(83)
Total gains	542.2146	662.6479	776.2127	889.0241	964.5159	952.1927	909.4028	841.0462	761.4949	645.9124	545.8977	506.7002	(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	56.7244	56.8710	57.0154	57.7037	57.8343	58.4502	58.4502	58.5657	58.2114	57.8343	57.5706	57.2976	
alpha	4.7816	4.7914	4.8010	4.8469	4.8556	4.8967	4.8967	4.9044	4.8808	4.8556	4.8380	4.8198	
util living area													
	0.9961	0.9895	0.9707	0.9117	0.7823	0.5959	0.4416	0.4948	0.7501	0.9488	0.9913	0.9972	(86)
MIT	19.7501	19.9602	20.2618	20.6165	20.8651	20.9724	20.9948	20.9911	20.9185	20.5724	20.0892	19.7134	(87)
Th 2	19.9007	19.9032	19.9056	19.9172	19.9194	19.9295	19.9295	19.9314	19.9256	19.9194	19.9150	19.9104	(88)
util rest of house													
	0.9948	0.9861	0.9610	0.8837	0.7223	0.5063	0.3367	0.3844	0.6644	0.9262	0.9878	0.9962	(89)
MIT 2	18.2514	18.5581	18.9923	19.4892	19.7971	19.9128	19.9278	19.9281	19.8663	19.4443	18.7558	18.2047	(90)
Living area fraction									fLA = Living area / (4) =			0.2853	(91)
MIT	18.6789	18.9581	19.3544	19.8108	20.1018	20.2150	20.2321	20.2313	20.1665	19.7661	19.1362	18.6351	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6789	18.9581	19.3544	19.8108	20.1018	20.2150	20.2321	20.2313	20.1665	19.7661	19.1362	18.6351	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9820	0.9547	0.8804	0.7333	0.5311	0.3667	0.4160	0.6853	0.9222	0.9843	0.9946	(94)
Useful gains	538.2639	650.7340	741.0550	782.7246	707.2786	505.6902	333.4868	349.8571	521.8196	595.6566	537.3440	503.9521	(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													
	1366.8911	1332.9493	1215.7381	1019.6036	783.3649	518.0172	335.0847	352.7632	561.9610	854.6295	1127.3687	1358.5066	(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													
	616.4987	458.4487	353.1643	170.5528	56.6082	0.0000	0.0000	0.0000	0.0000	192.6758	424.8178	635.7886	(98)
Space heating												2908.5548	(98)
Space heating per m2											(98) / (4) =	37.4572	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3114.0844	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	616.4987	458.4487	353.1643	170.5528	56.6082	0.0000	0.0000	0.0000	0.0000	192.6758	424.8178	635.7886	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	660.0628	490.8444	378.1202	182.6047	60.6084	0.0000	0.0000	0.0000	0.0000	206.2910	454.8370	680.7158	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6943	87.3597	86.6858	85.1833	82.7538	80.3000	80.3000	80.3000	80.3000	85.3717	87.1242	87.8011	(217)
Fuel for water heating, kWh/month													
	228.4981	200.7497	210.4909	189.9876	189.3418	171.8576	164.6527	183.5491	185.5762	198.7619	207.9064	222.8503	(219)
Water heating fuel used												2354.2223	(219)
Annual totals kWh/year													
Space heating fuel - main system												3114.0844	(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)												337.6044	(232)
Total delivered energy for all uses												5880.9111	(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	3114.0844	0.2160	672.6422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2354.2223	0.2160	508.5120	(264)
Space and water heating			1181.1542	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	337.6044	0.5190	175.2167	(268)
Total CO2, kg/m2/year			1395.2959	(272)
Emissions per m2 for space and water heating			15.2113	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2565	(272b)
Emissions per m2 for pumps and fans			0.5013	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2113 * 1.00) + 2.2565 + 0.5013, rounded to 2 d.p.			17.9700	(273)

11 Appendix 2 Sample Be Lean DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	2. Be Lean	**Issued on Date**	06/12/2023
Assessment Reference	Flat A	**Prop Type Ref**	
Property	58, Grenoble Gardens, London, N13 6JG		

SAP Rating	79 C	**DER**	25.44	**TER**	17.97
Environmental	80 C	**% DER<TER**	-41.58		
CO_2 Emissions (t/year)	1.52	**DFEE**	71.96	**TFEE**	50.20
General Requirements Compliance	Fail	**% DFEE<TFEE**	-43.34		

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

---

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

---

DWELLING AS DESIGNED

Ground-floor flat, total floor area 78 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:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.97 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 25.44 kgCO□/m²Fail
Excess emissions =7.47 kgCO□/m² (41.6%)

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)72.0 kWh/m²/yrFail
Excess energy =21.8 kWh/m²/yr (43.4%)

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

---

3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK

---

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
Manufacturer Manufacturer
Combi boiler
Efficiency: 88%
Minimum: 88% OK

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage: No cylinder

---

6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock: Yes OK

---

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

---

8 Mechanical ventilation
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 5.95 m², No overhang
Windows facing South: 7.78 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value: 0.00 W/m²K
Floor U-value: 0.12 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7569	(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	0.9651	0.9461	0.9272	0.8326	0.8137	0.7191	0.7191	0.7001	0.7569	0.8137	0.8515	0.8894	(22b)
Effective ac	0.9657	0.9476	0.9299	0.8466	0.8310	0.7585	0.7585	0.7451	0.7865	0.8310	0.8626	0.8955	(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	
Windows (Uw = 1.40)			13.7300	1.3258	18.2027			(27)
Rooflights (Uw = 1.40)			3.1000	1.3258	4.1098			(27a)
GF			77.6500	0.1200	9.3180			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.2500	11.2425			(29a)
Flat	32.1000	3.1000	29.0000	0.1400	4.0600			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9330			(33)
Party Wall 1			52.0000	0.0000	0.0000			(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)							25.2675	(36)
Total fabric heat loss						(33) + (36) =	72.2005	(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	68.0489	66.7746	65.5256	59.6590	58.5614	53.4517	53.4517	52.5055	55.4199	58.5614	60.7818	63.1033	(38)
Heat transfer coeff	140.2494	138.9751	137.7261	131.8595	130.7619	125.6522	125.6522	124.7060	127.6204	130.7619	132.9823	135.3038	(39)
Average = Sum(39)m / 12 =												131.8542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8062	1.7898	1.7737	1.6981	1.6840	1.6182	1.6182	1.6060	1.6435	1.6840	1.7126	1.7425	(40)
HLP (average)												1.6981	(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	2.4168	(42)
Average daily hot water use (litres/day)	91.5980	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	44.6898	47.6109	44.2682	43.8767	40.6545	42.0096	43.8767	44.2682	47.6109	47.8819	50.9589	(61)
Total heat required for water heating calculated for each month													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
								Total per year (kWh/year) = Sum(64)m =				1989.8589	(64)
Heat gains from water heating, kWh/month													
	62.4222	54.6251	56.7419	50.1589	48.4788	42.5316	40.4961	45.3873	45.8963	52.4928	56.2777	60.8545	(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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.1166	16.9792	13.8084	10.4538	7.8144	6.5972	7.1285	9.2659	12.4367	15.7913	18.4307	19.6479	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	(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)													
	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	(71)
Water heating gains (Table 5)													
	83.9008	81.2873	76.2660	69.6652	65.1597	59.0716	54.4302	61.0045	63.7448	70.5549	78.1635	81.7937	(72)
Total internal gains													
	379.7278	377.2023	363.4023	341.5082	319.2927	297.8234	284.2508	290.7371	302.2561	324.3595	349.6781	368.6895	(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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107	(83)
Total gains	542.2146	662.6479	776.2127	889.0241	964.5159	952.1927	909.4028	841.0462	761.4949	645.9124	545.8977	506.7002	(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	38.4484	38.8009	39.1528	40.8948	41.2380	42.9150	42.9150	43.2406	42.2531	41.2380	40.5495	39.8537	
alpha	3.5632	3.5867	3.6102	3.7263	3.7492	3.8610	3.8610	3.8827	3.8169	3.7492	3.7033	3.6569	
util living area													
	0.9958	0.9910	0.9796	0.9465	0.8700	0.7225	0.5696	0.6240	0.8457	0.9668	0.9923	0.9968	(86)
MIT	19.0530	19.2876	19.6568	20.1708	20.5845	20.8705	20.9612	20.9455	20.7375	20.1893	19.5664	19.0699	(87)
Th 2	19.4657	19.4772	19.4885	19.5422	19.5523	19.6000	19.6000	19.6089	19.5816	19.5523	19.5318	19.5105	(88)
util rest of house													
	0.9943	0.9877	0.9716	0.9244	0.8134	0.6079	0.4063	0.4615	0.7575	0.9487	0.9889	0.9956	(89)
MIT 2	17.7502	17.9916	18.3647	18.9027	19.2853	19.5449	19.5917	19.5955	19.4454	18.9375	18.3104	17.7998	(90)
Living area fraction									fLA = Living area / (4) =			0.2853	(91)
MIT	18.1218	18.3613	18.7333	19.2644	19.6559	19.9230	19.9824	19.9806	19.8140	19.2946	18.6687	18.1621	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1218	18.3613	18.7333	19.2644	19.6559	19.9230	19.9824	19.9806	19.8140	19.2946	18.6687	18.1621	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9923	0.9843	0.9662	0.9190	0.8182	0.6373	0.4538	0.5086	0.7749	0.9444	0.9860	0.9940	(94)
Useful gains	538.0318	652.2146	749.9667	817.0005	789.1856	606.8141	412.6921	427.7420	590.0815	609.9728	538.2460	503.6795	(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													
	1938.5026	1870.7881	1684.8452	1366.6511	1040.3283	668.8485	425.0001	446.5189	729.2183	1136.9170	1538.4268	1889.1229	(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													
	1041.9502	818.8814	695.5496	395.7484	186.8501	0.0000	0.0000	0.0000	0.0000	392.0465	720.1302	1030.7699	(98)
Space heating												5281.9264	(98)
Space heating per m2											(98) / (4) =	68.0222	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)												88.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6002.1890	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1041.9502	818.8814	695.5496	395.7484	186.8501	0.0000	0.0000	0.0000	0.0000	392.0465	720.1302	1030.7699	(98)
Space heating efficiency (main heating system 1)													
	88.0000	88.0000	88.0000	88.0000	88.0000	0.0000	0.0000	0.0000	0.0000	88.0000	88.0000	88.0000	(210)
Space heating fuel (main heating system)													
	1184.0344	930.5470	790.3973	449.7141	212.3297	0.0000	0.0000	0.0000	0.0000	445.5074	818.3298	1171.3294	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
Efficiency of water heater												88.0000	(216)
(217)m	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	88.0000	(217)
Fuel for water heating, kWh/month													
	227.7044	199.2890	207.3473	183.9066	178.0540	156.8201	150.2456	167.4886	169.3383	192.8254	205.8373	222.3467	(219)
Water heating fuel used												2261.2033	(219)
Annual totals kWh/year													
Space heating fuel - main system												6002.1890	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
Total electricity for the above, kWh/year												30.0000	(231)
Electricity for lighting (calculated in Appendix L)												337.6044	(232)
Total delivered energy for all uses												8630.9968	(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	6002.1890	0.2160	1296.4728	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2261.2033	0.2160	488.4199	(264)
Space and water heating			1784.8928	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	337.6044	0.5190	175.2167	(268)
Total CO2, kg/year			1975.6795	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			25.4400	(273)

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

DER		25.4400	ZC1
Total Floor Area	TFA	77.6500	
Assumed number of occupants	N	2.4168	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3662	ZC2
CO2 emissions from cooking, equation (L16)		2.2795	ZC3
Total CO2 emissions		44.0857	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		44.0857	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3319	(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	0.4232	0.4149	0.4066	0.3651	0.3568	0.3153	0.3153	0.3070	0.3319	0.3568	0.3734	0.3900	(22b)
Effective ac	0.5895	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5471	0.5551	0.5637	0.5697	0.5761	(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 Opening Type (Uw = 1.40)			13.7300	1.3258	18.2027			(27)
TER Room Window (Uw = 1.70)			3.1000	1.5918	4.9345			(27a)
GF			77.6500	0.1300	10.0945			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.1800	8.0946			(29a)
Flat	32.1000	3.1000	29.0000	0.1300	3.7700			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0962			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	8.4225	(36)
Total fabric heat loss (33) + (36) =	53.5187	(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	41.5438	41.2988	41.0586	39.9305	39.7194	38.7369	38.7369	38.5549	39.1153	39.7194	40.1464	40.5928	(38)
Heat transfer coeff	95.0625	94.8175	94.5773	93.4492	93.2381	92.2556	92.2556	92.0736	92.6341	93.2381	93.6651	94.1115	(39)
Average = Sum(39)m / 12 =												93.4482	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2211	1.2180	1.2035	1.2007	1.1881	1.1881	1.1858	1.1930	1.2007	1.2062	1.2120	(40)
HLP (average)												1.2035	(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	2.4168	(42)
Average daily hot water use (litres/day)	91.5980	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)
Water storage loss:													
Total storage 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	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	44.6898	47.6109	44.2682	43.8767	40.6545	42.0096	43.8767	44.2682	47.6109	47.8819	50.9589	(61)
Total heat required for water heating calculated for each month													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
									Total per year (kWh/year) = Sum(64)m =			1989.8589	(64)
Heat gains from water heating, kWh/month													
	62.4222	54.6251	56.7419	50.1589	48.4788	42.5316	40.4961	45.3873	45.8963	52.4928	56.2777	60.8545	(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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.1166	16.9792	13.8084	10.4538	7.8144	6.5972	7.1285	9.2659	12.4367	15.7913	18.4307	19.6479	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	(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)													
	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	(71)
Water heating gains (Table 5)													
	83.9008	81.2873	76.2660	69.6652	65.1597	59.0716	54.4302	61.0045	63.7448	70.5549	78.1635	81.7937	(72)
Total internal gains													
	379.7278	377.2023	363.4023	341.5082	319.2927	297.8234	284.2508	290.7371	302.2561	324.3595	349.6781	368.6895	(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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107	(83)
Total gains	542.2146	662.6479	776.2127	889.0241	964.5159	952.1927	909.4028	841.0462	761.4949	645.9124	545.8977	506.7002	(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	56.7244	56.8710	57.0154	57.7037	57.8343	58.4502	58.4502	58.5657	58.2114	57.8343	57.5706	57.2976	
alpha	4.7816	4.7914	4.8010	4.8469	4.8556	4.8967	4.8967	4.9044	4.8808	4.8556	4.8380	4.8198	
util living area													
	0.9961	0.9895	0.9707	0.9117	0.7823	0.5959	0.4416	0.4948	0.7501	0.9488	0.9913	0.9972	(86)
MIT	19.7501	19.9602	20.2618	20.6165	20.8651	20.9724	20.9948	20.9911	20.9185	20.5724	20.0892	19.7134	(87)
Th 2	19.9007	19.9032	19.9056	19.9172	19.9194	19.9295	19.9295	19.9314	19.9256	19.9194	19.9150	19.9104	(88)
util rest of house													
	0.9948	0.9861	0.9610	0.8837	0.7223	0.5063	0.3367	0.3844	0.6644	0.9262	0.9878	0.9962	(89)
MIT 2	18.2514	18.5581	18.9923	19.4892	19.7971	19.9128	19.9278	19.9281	19.8663	19.4443	18.7558	18.2047	(90)
Living area fraction									fLA = Living area / (4) =			0.2853	(91)
MIT	18.6789	18.9581	19.3544	19.8108	20.1018	20.2150	20.2321	20.2313	20.1665	19.7661	19.1362	18.6351	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6789	18.9581	19.3544	19.8108	20.1018	20.2150	20.2321	20.2313	20.1665	19.7661	19.1362	18.6351	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9927	0.9820	0.9547	0.8804	0.7333	0.5311	0.3667	0.4160	0.6853	0.9222	0.9843	0.9946	(94)
Useful gains	538.2639	650.7340	741.0550	782.7246	707.2786	505.6902	333.4868	349.8571	521.8196	595.6566	537.3440	503.9521	(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													
	1366.8911	1332.9493	1215.7381	1019.6036	783.3649	518.0172	335.0847	352.7632	561.9610	854.6295	1127.3687	1358.5066	(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													
	616.4987	458.4487	353.1643	170.5528	56.6082	0.0000	0.0000	0.0000	0.0000	192.6758	424.8178	635.7886	(98)
Space heating												2908.5548	(98)
Space heating per m2											(98) / (4) =	37.4572	(99)

8c. Space cooling requirement

Not applicable

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

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3114.0844	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	616.4987	458.4487	353.1643	170.5528	56.6082	0.0000	0.0000	0.0000	0.0000	192.6758	424.8178	635.7886	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	660.0628	490.8444	378.1202	182.6047	60.6084	0.0000	0.0000	0.0000	0.0000	206.2910	454.8370	680.7158	(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													
	200.3799	175.3743	182.4656	161.8378	156.6876	138.0016	132.2161	147.3900	149.0177	169.6864	181.1368	195.6651	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6943	87.3597	86.6858	85.1833	82.7538	80.3000	80.3000	80.3000	80.3000	85.3717	87.1242	87.8011	(217)
Fuel for water heating, kWh/month													
	228.4981	200.7497	210.4909	189.9876	189.3418	171.8576	164.6527	183.5491	185.5762	198.7619	207.9064	222.8503	(219)
Water heating fuel used												2354.2223	(219)
Annual totals kWh/year													
Space heating fuel - main system												3114.0844	(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)												337.6044	(232)
Total delivered energy for all uses												5880.9111	(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	3114.0844	0.2160	672.6422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2354.2223	0.2160	508.5120	(264)
Space and water heating			1181.1542	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	337.6044	0.5190	175.2167	(268)
Total CO2, kg/m2/year			1395.2959	(272)
Emissions per m2 for space and water heating			15.2113	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.2565	(272b)
Emissions per m2 for pumps and fans			0.5013	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2113 * 1.00) + 2.2565 + 0.5013, rounded to 2 d.p.			17.9700	(273)

12 Appendix 3 Sample Be Green DER/TER SAP Worksheets

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

Design SAP
elmhurst energy

Property Reference	3. Be Green	**Issued on Date**	06/12/2023
Assessment Reference	Flat A	**Prop Type Ref**	
Property	58, Grenoble Gardens, London, N13 6JG		

SAP Rating	80 C	**DER**	22.35	**TER**	24.95
Environmental	82 B	**% DER<TER**	10.42		
CO_2 Emissions (t/year)	1.38	**DFEE**	71.96	**TFEE**	50.20
General Requirements Compliance	Fail	**% DFEE<TFEE**	-43.34		

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

---

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

---

DWELLING AS DESIGNED

Ground-floor flat, total floor area 78 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) 24.95 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 22.35 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)72.0 kWh/m²/yrFail
Excess energy =21.8 kWh/m²/yr (43.4%)

---

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using default y-value of 0.15

---

3 Air permeability
Air permeability at 50 pascals: 15.00 (assumed) OK

---

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

Secondary heating system: None

---

5 Cylinder insulation
Hot water storage: Nominal cylinder loss: 0.08 kWh/day
Permitted by DBSCG 0.33 OK
Primary pipework insulated: Yes OK

---

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

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---

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

---

8 Mechanical ventilation
Not applicable

---

9 Summertime temperature
Overheating risk (Thames Valley): Medium OK
Based on:
Overshading: Average
Windows facing North: 5.95 m², No overhang
Windows facing South: 7.78 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: None

---

10 Key features
Party wall U-value 0.00 W/m²K
Floor U-value 0.12 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		No	
Measured/design AP50		15.0000	
Infiltration rate		0.8905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.7569	(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	0.9651	0.9461	0.9272	0.8326	0.8137	0.7191	0.7191	0.7001	0.7569	0.8137	0.8515	0.8894	(22b)
Effective ac	0.9657	0.9476	0.9299	0.8466	0.8310	0.7585	0.7585	0.7451	0.7865	0.8310	0.8626	0.8955	(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	
Windows (Uw = 1.40)			13.7300	1.3258	18.2027			(27)
Rooflights (Uw = 1.40)			3.1000	1.3258	4.1098			(27a)
GF			77.6500	0.1200	9.3180			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.2500	11.2425			(29a)
Flat	32.1000	3.1000	29.0000	0.1400	4.0600			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9330			(33)
Party Wall 1			52.0000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	25.2675	(36)
Total fabric heat loss (33) + (36) =	72.2005	(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	68.0489	66.7746	65.5256	59.6590	58.5614	53.4517	53.4517	52.5055	55.4199	58.5614	60.7818	63.1033	(38)
Heat transfer coeff	140.2494	138.9751	137.7261	131.8595	130.7619	125.6522	125.6522	124.7060	127.6204	130.7619	132.9823	135.3038	(39)
Average = Sum(39)m / 12 =												131.8542	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.8062	1.7898	1.7737	1.6981	1.6840	1.6182	1.6182	1.6060	1.6435	1.6840	1.7126	1.7425	(40)
HLP (average)												1.6981	(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	2.4168 (42)
Average daily hot water use (litres/day)	91.5980 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)

Water storage loss:	
Store volume	2.1000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0103 (51)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Volume factor from Table 2a												3.8517	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.0449	(55)
Total storage loss													
	1.3931	1.2583	1.3931	1.3482	1.3931	1.3482	1.3931	1.3931	1.3482	1.3931	1.3482	1.3931	(56)
If cylinder contains dedicated solar storage													
	1.3931	1.2583	1.3931	1.3482	1.3931	1.3482	1.3931	1.3931	1.3482	1.3931	1.3482	1.3931	(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													
	174.0764	152.9540	159.5102	141.4298	137.4663	121.2073	114.8620	128.1687	128.6097	146.7310	157.1151	169.3617	(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													
	174.0764	152.9540	159.5102	141.4298	137.4663	121.2073	114.8620	128.1687	128.6097	146.7310	157.1151	169.3617	(64)
Total per year (kWh/year) = Sum(64)m =												1731.4922	(64)
Heat gains from water heating, kWh/month													
	69.4069	61.2682	64.5636	58.1800	57.2340	51.4561	49.7180	54.1425	53.9173	60.3145	63.3954	67.8392	(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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.1166	16.9792	13.8084	10.4538	7.8144	6.5972	7.1285	9.2659	12.4367	15.7913	18.4307	19.6479	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	(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)													
	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	(71)
Water heating gains (Table 5)													
	93.2888	91.1729	86.7790	80.8056	76.9274	71.4667	66.8253	72.7722	74.8852	81.0679	88.0491	91.1817	(72)
Total internal gains													
	389.1158	387.0879	373.9153	352.6486	331.0605	310.2185	296.6459	302.5048	313.3965	334.8724	359.5637	378.0775	(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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107	(83)
Total gains	551.6026	672.5335	786.7257	900.1645	976.2836	964.5878	921.7979	852.8139	772.6353	656.4254	555.7833	516.0882	(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	38.4484	38.8009	39.1528	40.8948	41.2380	42.9150	42.9150	43.2406	42.2531	41.2380	40.5495	39.8537	
alpha	3.5632	3.5867	3.6102	3.7263	3.7492	3.8610	3.8610	3.8827	3.8169	3.7492	3.7033	3.6569	
util living area													
	0.9956	0.9906	0.9787	0.9447	0.8664	0.7167	0.5634	0.6175	0.8408	0.9652	0.9918	0.9966	(86)
MIT	19.0629	19.2979	19.6673	20.1806	20.5919	20.8742	20.9626	20.9474	20.7437	20.1994	19.5769	19.0800	(87)
Th 2	19.4657	19.4772	19.4885	19.5422	19.5523	19.6000	19.6000	19.6089	19.5816	19.5523	19.5318	19.5105	(88)
util rest of house													
	0.9939	0.9871	0.9705	0.9219	0.8089	0.6018	0.4012	0.4557	0.7513	0.9464	0.9882	0.9953	(89)
MIT 2	16.9676	17.3163	17.8574	18.6186	19.1695	19.5220	19.5884	19.5901	19.3881	18.6653	17.7579	17.0196	(90)
Living area fraction									fLA = Living area / (4) =			0.2853	(91)
MIT	17.5653	17.8815	18.3737	19.0641	19.5753	19.9077	19.9804	19.9773	19.7748	19.1029	18.2768	17.6073	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.5653	17.8815	18.3737	19.0641	19.5753	19.9077	19.9804	19.9773	19.7748	19.1029	18.2768	17.6073	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9816	0.9617	0.9121	0.8100	0.6298	0.4480	0.5021	0.7660	0.9381	0.9834	0.9928	(94)
Useful gains	546.4830	660.1520	756.6075	821.0332	790.7553	607.5415	412.9798	428.1601	591.8478	615.8190	546.5845	512.3543	(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													
	1860.4510	1804.1098	1635.3142	1340.2367	1029.7850	666.9279	424.7513	446.1058	724.2149	1111.8582	1486.3164	1814.0632	(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													
	977.5922	768.7396	653.7578	373.8265	177.8381	0.0000	0.0000	0.0000	0.0000	369.0532	676.6069	968.4715	(98)
Space heating												4965.8858	(98)
Space heating per m2											(98) / (4) =	63.9522	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	1987.1492	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	977.5922	768.7396	653.7578	373.8265	177.8381	0.0000	0.0000	0.0000	0.0000	369.0532	676.6069	968.4715	(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)													
	391.1934	307.6189	261.6078	149.5904	71.1637	0.0000	0.0000	0.0000	0.0000	147.6803	270.7511	387.5436	(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		
174.0764 152.9540 159.5102 141.4298 137.4663 121.2073 114.8620 128.1687 128.6097 146.7310 157.1151 169.3617		(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		
99.4154 87.3524 91.0966 80.7709 78.5073 69.2218 65.5979 73.1975 73.4493 83.7984 89.7288 96.7228		(219)
Water heating fuel used	988.8590	(219)
Annual totals kWh/year		
Space heating fuel - main system	1987.1492	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
Total electricity for the above, kWh/year	30.0000	(231)
Electricity for lighting (calculated in Appendix L)	337.6044	(232)
Total delivered energy for all uses	3343.6127	(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	1987.1492	0.5190	1031.3304	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	988.8590	0.5190	513.2178	(264)
Space and water heating			1544.5483	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	337.6044	0.5190	175.2167	(268)
Total CO2, kg/year			1735.3350	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			22.3500	(273)

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

DER		22.3500	ZC1
Total Floor Area	TFA	77.6500	
Assumed number of occupants	N	2.4168	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3662	ZC2
CO2 emissions from cooking, equation (L16)		2.2795	ZC3
Total CO2 emissions		40.9957	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		40.9957	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	77.6500 (1b)	x	2.7500 (2b)	=	213.5375	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.6500					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	213.5375	(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							3 * 10 =	30.0000	(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) =	30.0000 / (5) =	0.1405	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3905	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3319	(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	0.4232	0.4149	0.4066	0.3651	0.3568	0.3153	0.3153	0.3070	0.3319	0.3568	0.3734	0.3900	(22b)
Effective ac	0.5895	0.5861	0.5827	0.5667	0.5637	0.5497	0.5497	0.5471	0.5551	0.5637	0.5697	0.5761	(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 Opening Type (Uw = 1.40)			13.7300	1.3258	18.2027			(27)
TER Room Window (Uw = 1.70)			3.1000	1.5918	4.9345			(27a)
GF			77.6500	0.1300	10.0945			(28a)
External Wall 1	58.7000	13.7300	44.9700	0.1800	8.0946			(29a)
Flat	32.1000	3.1000	29.0000	0.1300	3.7700			(30)
Total net area of external elements Aum(A, m2)			168.4500					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.0962			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (User defined value 0.050 * total exposed area)	8.4225	(36)
Total fabric heat loss (33) + (36) =	53.5187	(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	41.5438	41.2988	41.0586	39.9305	39.7194	38.7369	38.7369	38.5549	39.1153	39.7194	40.1464	40.5928	(38)
Heat transfer coeff	95.0625	94.8175	94.5773	93.4492	93.2381	92.2556	92.2556	92.0736	92.6341	93.2381	93.6651	94.1115	(39)
Average = Sum(39)m / 12 =												93.4482	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2242	1.2211	1.2180	1.2035	1.2007	1.1881	1.1881	1.1858	1.1930	1.2007	1.2062	1.2120	(40)
HLP (average)												1.2035	(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	2.4168 (42)
Average daily hot water use (litres/day)	91.5980 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	100.7578	97.0939	93.4300	89.7661	86.1021	82.4382	82.4382	86.1021	89.7661	93.4300	97.0939	100.7578	(44)
Energy conte	149.4210	130.6845	134.8547	117.5696	112.8108	97.3472	90.2065	103.5132	104.7495	122.0755	133.2549	144.7062	(45)
Energy content (annual)										Total = Sum(45)m =		1441.1937	(45)
Distribution loss (46)m = 0.15 x (45)m	22.4131	19.6027	20.2282	17.6354	16.9216	14.6021	13.5310	15.5270	15.7124	18.3113	19.9882	21.7059	(46)

Water storage loss:	
Store volume	2.1000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	0.2411 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.1302 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss

	4.0358	3.6453	4.0358	3.9056	4.0358	3.9056	4.0358	4.0358	3.9056	4.0358	3.9056	4.0358 (56)

If cylinder contains dedicated solar storage

	4.0358	3.6453	4.0358	3.9056	4.0358	3.9056	4.0358	4.0358	3.9056	4.0358	3.9056	4.0358 (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

	176.7192	155.3410	162.1529	143.9873	140.1091	123.7648	117.5047	130.8115	131.1672	149.3737	159.6726	172.0044 (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

	176.7192	155.3410	162.1529	143.9873	140.1091	123.7648	117.5047	130.8115	131.1672	149.3737	159.6726	172.0044 (64)
								Total per year (kWh/year) = Sum(64)m =				1762.6083 (64)

Heat gains from water heating, kWh/month

	71.5211	63.1778	66.6778	60.2260	59.3482	53.5020	51.8322	56.2567	55.9633	62.4287	65.4414	69.9534 (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	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	120.8380	(66)

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

	19.1166	16.9792	13.8084	10.4538	7.8144	6.5972	7.1285	9.2659	12.4367	15.7913	18.4307	19.6479 (67)

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

	214.4590	216.6845	211.0765	199.1378	184.0673	169.9032	160.4407	158.2153	163.8232	175.7620	190.8324	204.9965 (68)

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

	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838	35.0838 (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)

	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704	-96.6704 (71)

Water heating gains (Table 5)

	96.1304	94.0145	89.6207	83.6472	79.7691	74.3084	69.6670	75.6139	77.7268	83.9095	90.8908	94.0234 (72)

Total internal gains

	391.9574	389.9296	376.7569	355.4902	333.9021	313.0602	299.4876	305.3465	316.2382	337.7141	362.4053	380.9192 (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	5.9500	10.6334	0.6300	0.7000	0.7700	19.3357	(74)
South	7.7800	46.7521	0.6300	0.7000	0.7700	111.1609	(78)
Horizontal	3.1000	26.0000	0.6300	0.7000	1.0000	31.9901	(82)

Solar gains	162.4868	285.4456	412.8104	547.5159	645.2232	654.3693	625.1520	550.3091	459.2388	321.5530	196.2196	138.0107 (83)
Total gains	554.4442	675.3752	789.5673	903.0061	979.1253	967.4295	924.6396	855.6556	775.4769	659.2671	558.6249	518.9299 (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	56.7244	56.8710	57.0154	57.7037	57.8343	58.4502	58.4502	58.5657	58.2114	57.8343	57.5706	57.2976	
alpha	4.7816	4.7914	4.8010	4.8469	4.8556	4.8967	4.8967	4.9044	4.8808	4.8556	4.8380	4.8198	
util living area	0.9957	0.9887	0.9688	0.9074	0.7753	0.5879	0.4346	0.4869	0.7412	0.9451	0.9904	0.9969	(86)
MIT	19.7643	19.9746	20.2755	20.6271	20.8705	20.9740	20.9951	20.9917	20.9227	20.5846	20.1037	19.7278	(87)
Th 2	19.9007	19.9032	19.9056	19.9172	19.9194	19.9295	19.9295	19.9314	19.9256	19.9194	19.9150	19.9104	(88)
util rest of house	0.9943	0.9850	0.9585	0.8784	0.7148	0.4990	0.3312	0.3779	0.6550	0.9212	0.9866	0.9958	(89)
MIT 2	18.2721	18.5788	19.0114	19.5027	19.8026	19.9138	19.9279	19.9283	19.8699	19.4603	18.7767	18.2257	(90)
Living area fraction									fLA = Living area / (4) =			0.2853	(91)
MIT	18.6978	18.9769	19.3720	19.8234	20.1073	20.2162	20.2323	20.2317	20.1702	19.7810	19.1552	18.6542	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6978	18.9769	19.3720	19.8234	20.1073	20.2162	20.2323	20.2317	20.1702	19.7810	19.1552	18.6542	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9921	0.9807	0.9522	0.8755	0.7261	0.5236	0.3608	0.4091	0.6762	0.9174	0.9829	0.9940	(94)
Useful gains	550.0375	662.3669	751.7951	790.6115	710.9651	506.5238	333.6149	350.0910	524.3832	604.8379	549.0931	515.8337	(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	1368.6896	1334.7376	1217.3968	1020.7839	783.8769	518.1256	335.1021	352.7944	562.3065	856.0184	1129.1545	1360.3036	(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	609.0772	451.8331	346.4076	165.7241	54.2463	0.0000	0.0000	0.0000	0.0000	186.8783	417.6442	628.2856	(98)
Space heating												2860.0964	(98)
Space heating per m2											(98) / (4) =	36.8332	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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												3058.9267	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	609.0772	451.8331	346.4076	165.7241	54.2463	0.0000	0.0000	0.0000	0.0000	186.8783	417.6442	628.2856	(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)													
	651.4195	483.2440	370.4894	177.2450	58.0175	0.0000	0.0000	0.0000	0.0000	199.8698	446.6783	671.9632	(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													
	176.7192	155.3410	162.1529	143.9873	140.1091	123.7648	117.5047	130.8115	131.1672	149.3737	159.6726	172.0044	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8509	87.4984	86.7895	85.1895	82.5232	79.8000	79.8000	79.8000	79.8000	85.4124	87.2638	87.9650	(217)
Fuel for water heating, kWh/month													
	201.1581	177.5358	186.8347	169.0199	169.7814	155.0938	147.2490	163.9242	164.3699	174.8852	182.9768	195.5374	(219)
Water heating fuel used												2088.3662	(219)
Annual totals kWh/year													
Space heating fuel - main system												3058.9267	(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)												337.6044	(232)
Total delivered energy for all uses												5559.8973	(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	3058.9267	0.2160	660.7282	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2088.3662	0.2160	451.0871	(264)
Space and water heating			1111.8153	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	337.6044	0.5190	175.2167	(268)
Total CO2, kg/m2/year			1325.9570	(272)
Emissions per m2 for space and water heating			14.3183	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2565	(272b)
Emissions per m2 for pumps and fans			0.5013	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3183 * 1.55) + 2.2565 + 0.5013, rounded to 2 d.p.			24.9500	(273)

13 Appendix 4 SAP 10 GLA Carbon Spreadsheet Summary

SAP 2012 Performance

Domestic

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	4.3	
After energy demand reduction (be lean)	4.0	
After heat network connection (be clean)	4.0	
After renewable energy (be green)	3.5	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: savings from energy demand reduction	0.4	8%
Be clean: savings from heat network	0.0	0%
Be green: savings from renewable energy	0.5	11%
Cumulative on site savings	**0.8**	**19%**
Annual savings from off-set payment	3.5	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**106**	-
Cash in-lieu contribution (£)	**10,029**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

SAP 10.0 Performance

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic b

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	4.0	
After energy demand reduction (be lean)	3.7	
After heat network connection (be clean)	3.7	
After renewable energy (be green)	1.6	

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for do

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Be lean: Savings from energy demand reduction	0.3	8%
Be clean: Savings from heat network	0.0	0%
Be green: Savings from renewable energy	2.1	52%
Cumulative on site savings	**2.4**	**60%**
Annual savings from off-set payment	1.6	-
	(Tonnes CO_2)	
Cumulative savings for off-set payment	**47**	-
Cash in-lieu contribution (£)	**4,502**	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

uildings

mestic buildings