

Sustainability Statement for Planning

Client: Atlas Property London

Site: 18 Denmark Street
London
N17 0JL

Proposals: The construction of 6 new dwellings consisting of a run of 4 terrace houses with 2 apartments.

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Report Details:

Assessor	Checked	Date	Job
CT	PK	04/04/2023	Rev0

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1 - Introduction

This Sustainability Statement (SS) has been prepared in support of the planning application for the proposed redevelopment of 18 Denmark Street in London.

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.

The London Plan has recently been updated for energy assessments. However, the below guidance has been used which refers to sustainability measure.

The London Plan 2021 (previously London Plan 2016).

All planning applications across the area are to take into account the requirements of The London Plan.

Within the Plan, Policy 5.3 Sustainable Design and Construction SPG sets out the following:

Strategic

A - The highest standards of sustainable design and construction should be achieved in London to improve the environmental performance of new developments and to adapt to the effects of climate change over their lifetime.

Planning Decisions

B - Development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

C - Major development proposals should meet the minimum standards outlined in the Mayor's supplementary planning guidance and this should be clearly demonstrated within a design and access statement. The standards include measures to achieve other policies in this Plan and the following sustainable design principles:

- a** minimising carbon dioxide emissions across the site, including the building and services (such as heating and cooling systems)
- b** avoiding internal overheating and contributing to the urban heat island effect

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- c** efficient use of natural resources (including water), including making the most of natural systems both within and around buildings
 - d** minimising pollution (including noise, air and urban runoff)
 - e** minimising the generation of waste and maximising reuse or recycling
 - f** avoiding impacts from natural hazards (including flooding)
 - g** ensuring developments are comfortable and secure for users, including avoiding the creation of adverse local climatic conditions
 - h** securing sustainable procurement of materials, using local supplies where feasible, and
 - i** promoting and protecting biodiversity and green infrastructure.

LDF Preparation

D - Within LDFs boroughs should consider the need to develop more detailed policies and proposals based on the sustainable design principles outlined above and those which are outlined in the Mayor's supplementary planning guidance that are specific to their local circumstances".

Haringey Council

The Core strategy sets out to promote Sustainable Development. Furthermore, Sustainable Design and Construction Policy UD2, requires a sustainability statement to be provided for all planning applications in line with the key principals of the Sustainable Design and Construction.

3 - Existing and Proposed Development

The site is located on land to 18 Denmark Street (see Figure 1). The site is currently a small brown field to the rear of existing residential buildings.

Proposal are for the construction of 6 new dwellings consisting of a run of 4 terrace houses with 2 apartments.

Given the scale and nature of the development, this constrains the development proposals in terms of the layout, positioning and orientation of the proposed dwellings. Subsequently, these constraints will impact on the feasibility of certain sustainability and energy efficient measures that can feasibly be incorporated into the new dwellings.



4 – Sustainability Statement

<u>Energy</u>	
Issue	Compliance
Energy Demand	Throughout the new development of 18 Denmark Street, best efforts have been made to reduce the need for energy and reduce heat demand. A preliminary Energy assessment has been carried out on sample dwellings to show how the development can be improved. As the drawings supplied are at a planning stage, assumptions have been made about the construction, heating and ventilation. Therefore the energy strategy that has been used should be a guide only.
Maximise use of passive energy	Through the use of passive and active design measures the design team have enabled the development to require less energy through the use of optimised insulation, cross ventilation, improved window u-values, higher air tightness, reduced cold bridging and light-coloured materials.
Increased Energy Efficiency	An Energy Statement has been completed for this site, which show the dwellings will go beyond building regulations Part L1a 2013 and has used SAP 10 carbon factors to show compliance under Part L1 2021. The dwellings will incorporate: • Low fabric element u-values, External wall u-value 0.18W/m2k, Floor 0.11W/m2k, Roof 0.13W/m2k windows 1.3W/m2k. • High efficiency gas heating system • Time and temperature zone control,

	This has shown to be an improvement over building regulations Part L1a 2013 baseline, by achieving a potential of 81% improvement in CO2 emissions, which equates to a saving of 7,380Kg/year CO2. When using SAP 10 carbon factors the development achieves a total of 46% improvement in CO2 emissions which equates to a 5,944 Kg/year CO2. If required, the ES also shows the impact of installing an ASHP to reduce the development CO2 emissions further using SAP 10 carbon factors. With the addition on the ASHP this shows a potential improvement of 94% improvement in CO2 emissions which equates to 7,152 Kg/year CO2.
Renewable Energy Sources	The feasibility of several renewable technologies has been reviewed and shown that the majority of these are not feasible, as shown in the Energy Statement. There is enough space for solar PV to be displayed on the horizontal roof space. A 2.4kWp system on average for each dwelling is to be installed on the development. There would also be potentially enough space to install a ASHP on each dwelling. However feasibility for each renewable technology should be gained from a specialist.
Responsible Travel Provisions	This site is an urban area and therefore has excellent access to public transport. Including Northumberland train station 300m away, White Hart Lane train station is approximately 800m away and several bus nodes are located along High Road and Northumberland Park. There will be cycle storage for 14 bicycles provided for the occupiers to the promote healthier travel methods to reduce CO2 emissions for the vehicles. The storage space for the bicycles will be covered and secure and will be located at the north of the development.

<u>Water</u>	
Issue	Compliance
Water Saving Measures	Initial advice from the design team suggests the water saving measures can be incorporated in order to reduce water usage. It has been identified that there is the opportunity to have low flow rates and dual flush toilets.
Water Consumption Targets	Water efficient fixtures, fittings and appliances will be provided to ensure that internal water use targets are achieved to comply with the local council of Haringey target of 105 L/person/day. In comparison, Building Regulations Approved Document G requires internal water use to be at 125litres/person/day or less.
Reusing Water	A preliminary feasibility study of the potential to include rainwater harvesting should be carried out; given the nature of the development however it may be considered not feasible to install a rainwater harvesting system. Further assessment with a drainage engineer would be needed. A rainwater butt will be installed and to be designed into the dwellings for the watering of the external rear garden.
Metering	A water meter could be provided. During detailed design, consideration will be given to the provision of digital meters with connectivity to a central building management / billing system, rather than standard analogue meters.

<u>Materials and Waste</u>	
Issue	Compliance
Design Stage Choosing materials that minimise the use of resources are sustainably sourced, do not cause harm to health and are robust.	The contractor and developer will need to design and choose materials that will influence the construction process and the embodied carbon of the development by, specifying materials using the Building Research Establishment's Green Guide Specification. Ensuring that materials are responsibly sourced, sourcing materials from local sources, minimising the harmful effects of some materials on human health, ensuring that specified materials are robust and sensitive to the building type and age. It is intended that insulation materials will have an Ozone Depletion Potential (ODP) of zero, and a Global Warming Potential (GWP) of less than five. Where specified by the developer (e.g. low VOC paint), finishes and other materials will not contain or emit toxic substances. Where timber is installed it will be 100% legally sourced and FSC certified. Additionally, a sustainable procurement plan should be development and used by the design team to guide specification towards sustainable construction products
Construction Stage Management of materials resulting from demolition through the waste hierarchy	The Contractor will need to reduce waste during the construction phase of the development via the hierarchy of, Reduce, Reuse (prioritising on-site reuse of demolition materials, followed by offsite reuse), Recycle (prioritising on-site recycling, then off-site recycling), Resource recovery (for energy generation processes – fuels, heat and power); and Disposal. Due to the limited amounts of demolition there will be very little resources that can be recycled in the development. A Site Waste Management Plan (SWMP) will be prepared and incorporate non-hazardous waste, demolition and excavation waste if applicable.

	The BRE Smartwaste tool can be used as an easy tool by contractors.
Storage for Recyclables & Waste	Sufficient internal and external space will be provided to facilitate recycling and composting and the good management of waste for the building occupiers. The dwelling/s will be fitted with internal waste storage facilities in the kitchen for the segregation of recyclable materials, in compliance with BS5096.

Nature Conservation and Biodiversity

Issue	Compliance
Protecting Species Promoting the Protection and Planting of Trees	The existing site is a building with hardstanding areas and is considered to be of low ecological value. Existing trees (and the space they require) have been considered throughout this development. It has not been necessary to remove any trees on site. However, there are features of ecological significance (Trees) with two being a protected Sycamore, next to the construction zone. These will have to be adequately protected. Whilst measures to enhance the ecological potential of the site will be investigated where possible, opportunities to enhance the ecological value of the site are limited.
Designing development proposals	The green space has been reduced in compared to the previous site, however there will be new gardens to the dwellings. Efforts will be made to improve the ecological value of the site with planting of native plant species and bird boxes to the rear relevant to the native. Bird boxes will be located to the rear of each dwelling. There is also the opportunity of planting not native varieties of plants taking into

	consideration the affects of climate change. Developers should adhere to the following hierarchy when considering biodiversity on their development by; avoiding adverse impact to the biodiversity interest, minimise impact, seek mitigation, and seek appropriate compensation where the benefits of the proposal clearly outweigh the biodiversity impacts
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Increased Green Cover and Trees

Issue	Compliance
Promoting Urban Greening	To help the city to adapt to future climates. Green infrastructure is a network of mainly vegetated spaces and other environmental features which can promote urban cooling, reduced runoff, reduced energy demand, improved air quality, improved biodiversity, enhanced aesthetic and an increased health and well-being. The development will look to encompass ecological features such as native plant species and trees in the rear garden. A Sedum Green roof is proposed for the dwellings within the development.

Tackling Increased Temperatures and Drought

Issue	Compliance
Preventing Developments from Overheating	Overheating within buildings can result from either too much heat entering a building and not being released or too much heat being generated within a building and not being released. Therefore, if the internal environment becomes too hot it is likely occupiers will try to find a way to cool their environment. In order to continue minimising CO₂ emissions the design team have considered the internal comfort and implemented the following measures to reduce over heating, via cross ventilation, lightly colours external walls, and blinds. To ensure the dwelling is not an overheating risk a Part O assessment will be carried out.
Promoting Heat and Drought Resistant Planting	London's water demand already outstrips mains water supply. Therefore it is essential that landscaping does not use excessive amounts of water. have ensured the landscaping of the development does not require excessive amounts of water. Consideration will be given the including plant species which are heat and drought resistant. Advice from an ecologist should ideally be sought before any plant species are selected.

Flooding	
Issue	Compliance
Surface Water Flooding	Surface water flooding is the most likely form of flooding that development may be exposed to. Surface water flooding is likely to increase due to the anticipated increased intensity in rainfall events as well as the continuing urbanisation of London. Based on the review of the London Plan 2021 drainage hierarchy, and recording the underlying ground conditions and constraints of the site, the following SuDS are proposed: - Simple rainwater recycling (water butt) - Attenuation storage with a controlled outlet into the public surface water sewer
Flooding Resilience and Resistance	The site is shown to be located largely within Flood Zone 2, with a small section in Flood Zone 1. Wherever feasible, flood resilient measures will be included in line with guidance provided in the Communities and Local Government Document, <i>Improving the Flood Performance of New Buildings: Flood Resilient Construction</i>¹. These could include: - Where possible, all service entries will be sealed (e.g. with expanding foam or similar closed cell material). - Pipework: Closed cell insulation - Drainage services: Non-return valves in the drainage system to prevent back-flow of diluted sewage in situations where there is an identified risk of the foul sewer surcharging. Maintenance of these valves is important to ensure their continued effectiveness. - Water, electricity and gas meters raised - Electrical services: electrical sockets raised

¹ Improving the Flood Performance of New Buildings: Flood Resilient Construction. Department for Communities and Local Government. May 2007.

Flooding and Basement Developments	There is no basement planned for the proposed development.

<u>Land Contamination</u>	
Issue	Compliance
Responsible Person/Organisation	The current site is not identified as being contaminated as a result of previous uses.
Bioremediation	Bioremediation is not required.

<u>Air Pollution</u>	
Issue	Compliance
Assessment Requirements	An air quality test should not be needed for the proposed development being located on a residential road.
Construction and Demolition	To recognise and encourage construction-sites which are managed in an environmentally and socially considerate, responsible and accountable manner. For the proposed development, the contractor will comply with 'The Control of Dust and Emissions during Construction Demolition SPG'. Control measures will be implemented by the contractor on site to prevent air and dust pollution. An example of this could be using dust sheets on materials and skips, damping down in waste areas.
Design and Occupation	Ventilation pathways will need to be designed to reduce the build-up of air pollutants in the dwelling/s, through cross ventilation, and either naturally ventilated or mechanical ventilation. Where there is mechanical ventilation, exhaust flues will be positioned away from intake flues for fresh air. In naturally ventilated buildings/spaces: openable windows/ventilators are over 10m from sources of external pollution. There is no requirement for mechanical ventilation for this development however once the over heating assessment has been completed this will be confirmed.

Noise	
Issue	Compliance
Sources of Noise	The proposed site is located within an existing built up residential area, with few commercial units in the vicinity. The area is identified having a low potential for noise pollution from residential dwellings.
Mitigation of Noise Emitted by Development	Noise attenuation measures will be incorporated on-site where required, to ensure that any noise generated by equipment or services will not generate a source of noise pollution or negatively impact the surrounding area. The developer will comply with the council's construction noise rules which states what hours of the day the site can work within.
Mitigation of Noise impacts on the Development	For the occupiers of the dwellings, the specification of the partition walls, floors and external walls will be designed to go beyond Document E of the building regulations. The following should be followed, and best efforts will be made here were possible to avoid impacts of external noise to the occupiers. Locate noise sensitive areas/rooms away from the parts of the site most exposed to noises, create setbacks, design the building so its shape and orientation reflect noise and protect the most sensitive uses, position non-residential uses closer to the noise source in mixed use developments, design in lobbies, balconies, winter gardens and dual facades; and carefully locate noise generating equipment for the building such as plant and services away from sensitive uses.

<u>Light Pollution</u>	
Issue	Compliance
Type of Light Pollution	Light pollution comprises any adverse effect of lighting for building occupiers, and for this development includes; Glare, 'Light Trespass' and 'Sky Glow' and Poor Artificial Lighting
Potential Effects	Light pollution can have a detrimental impact on the quality of life of residents; by significantly changing the character of the locality, altering wildlife and ecological patterns and wasting energy
Lighting Design to Minimise Impacts	To minimise obtrusive light where applicable, lights will be designed to be used only in appropriate areas, and that upward lighting is minimised, this will help to reduce light pollution and effect to neighbours. Where there is external lighting, it will have to be designed to the following standards. First to be energy efficient going beyond Part L of the building regulations, with the aim to achieve no less than 60 lumens per circuit watt. Second all external lights will be automatically controlled for the prevention of operation during daylight hours and presence detection in areas of intermitted pedestrian traffic. The ILP Guidance for the reduction of obtrusive light, 2001 will be used to design the lighting strategy. All external lighting (except for safety and security lighting) can be automatically switched off between 23:00 and 07:00. If safety or security lighting is provided and will be used between 23:00 and 07:00, this part of the lighting system complies with the lower levels of lighting recommended during these hours in Table 2 of the ILP's Guidance notes. Illuminated advertisements, where specified, must be designed in compliance with ILE Technical Report 5 – The Brightness of Illuminated Advertisements

<u>Water Pollution</u>	
Issue	Compliance
How Sustainable Drainage Contributes to Water Quality	There are no activities on site which lead to pollutants accumulating on hardstanding areas, therefore traditional drainage systems will be sufficient. Where applicable, the design team will incorporate the drainage hierarchy set out in London Plan Policy 5.3. Further details is required by a drainage engineer.
Connection of New Developments to the Sewer Network	The site is in close proximity to the main sewer network therefore connection should not be a problem.

5 Conclusion

The proposed development is to be located on land at the rear of 18 Denmark Street, where the existing site is currently an abandon small brown field site to the rear of existing dwellings. Proposals are for the construction of 6 new dwellings consisting of a run of 4 terrace houses with 2 apartments.

Haringey Council Local Plan sets out Policy UD2: Sustainable Design and Construction, requires a sustainability statement to be provided for all planning applications in line with the key principals of the Sustainable Design and Construction of the London Plan Policy 5.3 to promote Sustainable Development.

Given the scale and nature of the development, this constrains the development proposals in terms of the layout, positioning and orientation of the proposed dwelling. Subsequently, these constraints will impact on the feasibility of certain sustainability and energy efficient measures that can feasibly be incorporated into the development (as discussed in Section 4 of this report).

The above sustainability statement sets out what the requirements are of the planning policies and what can be achieved for the proposed development.

The main features of the site to meet the building environmental standards are:

- The energy efficiency measures of the building are to go beyond Part L1a 2013, with potentially a 81% improvement
- When using the SAP 10 GLA spread sheet this is shown to be a 46% improvement in CO2 emissions. Further improvement can be made with the incorporation of an ASHP. This is stated in the ES.
- The development is to take a fabric first approach, which is to be designed to be highly insulated, with low u-values, good air tightness, high heating efficiency and controls.
- Water efficiency is a big driver of sustainability and indoor fittings which will have water efficiency will be installed. These will help to go beyond Part G minimum standard of 125L/person/day and achieve a 105L/person/day
- Materials to be used in the proposed development are to consist of having a high Green Guide rating, using the BRE Green Guide for reference. 100% of all timber used on site is to be sustainably sourced. Where possible recycled aggregates will be used.
- The contractor to be used for this development will need to monitor, record construction site impacts (energy, water and transport), having policies in place for reducing air and surface water pollution
- The contractor will need to have a site waste management plan in place from the beginning of construction and use this throughout the construction period. Any demolition waste will be recycled
- The location lends itself to excellent transport links

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- To reduce surface water the following SuDS are proposed Simple rainwater recycling (water butt) and the attenuation storage with a controlled outlet into the public surface water sewer

Appendix A Site Plan



GENERAL PLANNING NOTES

1. No dimensions to be scaled from this drawing.

2. All errors, omissions or inconsistencies to be reported to the architect immediately.

3. Use figured dimensions only. All dimensions to be checked on site prior to construction and/or fabrication.

01 Proposed Site Plan
1:100 @ A1



PLANNING

Project No. 2210

Client Atlas Property London Ltd

Date 15/10/2020

Scale A3 / 1:100 @ A1

Project 18, Dagenham Road, London, N17 0JL

Drawing Title: Proposed Site Plan

Drawing No. 2210_10_10 Rev.

Drawn Approved Signed

Copyright © Hill Patru Architects.

No implied license exists. This drawing should not be used to calculate areas for the purposes of valuation. All dimensions to be checked on site by the contractor and such dimensions to be their responsibility.

Do not scale drawings

All work must comply with relevant British Standards and Building Regulations requirements. Drawing errors and omissions to be reported to the architect.

Appendix B SAP Worksheet Baseline/Be Lean

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	S10920 01			Issued on Date	06/04/2023
Assessment Reference	Be lean	Prop Type Ref			
Property	Denmark Street, N17 0JL				
SAP Rating	84 B	DER	18.01	TER	20.58
Environmental	86 B	% DER<TER	12.51		
CO ₂ Emissions (t/year)	1.23	DFEE	56.98	TFEE	67.49
General Requirements Compliance	Pass	% DFEE<TFEE	15.57		
Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk			Assessor ID	L770-0002
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 87 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) 20.58 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.01 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 67.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 57.0 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.30 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Assure 30 Combi
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

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): Slight OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing South: 14.29 m², No overhang
Windows facing West: 10.77 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.11 W/m²K
Exposed floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.6000 (2b)	= 134.0560 (1b) - (3b)
First floor	34.9800 (1c)	x 2.9000 (2c)	= 101.4420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.4980 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1274 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3274 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3028 (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	0.3861	0.3785	0.3710	0.3331	0.3255	0.2877	0.2877	0.2801	0.3028	0.3255	0.3407	0.3558 (22b)
Effective ac	0.5745	0.5716	0.5688	0.5555	0.5530	0.5414	0.5414	0.5392	0.5459	0.5530	0.5580	0.5633 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.30)			26.0200	1.2357	32.1540		(27)
Roof light (Uw = 1.30)			1.4400	1.2357	1.7795		(27a)
Ground floor			51.1300	0.1100	5.6243		(28a)
Exposed floor			0.4300	0.1100	0.0473		(28b)
External wall	140.5300	26.0200	114.5100	0.1800	20.6118		(29a)
Flat roof	34.9800	1.4400	33.5400	0.1300	4.3602		(30)
Balcony roof	17.0000		17.0000	0.1300	2.2100		(30)
Total net area of external elements Aum(A, m ²)			244.0700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.7871		(33)
Party Wall 1			13.2300	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6802 (36)
Total fabric heat loss						(33) + (36) =	94.4673 (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	44.6502	44.4252	44.2047	43.1691	42.9753	42.0733	42.0733	41.9062	42.4207	42.9753	43.3673	43.7771 (38)
Heat transfer coeff	139.1174	138.8925	138.6720	137.6363	137.4426	136.5405	136.5405	136.3735	136.8880	137.4426	137.8346	138.2444 (39)
Average = Sum(39)m / 12 =												137.6354 (39)
HLP	1.6076	1.6050	1.6024	1.5904	1.5882	1.5778	1.5778	1.5758	1.5818	1.5882	1.5927	1.5975 (40)
HLP (average)												1.5904 (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												2.5753 (42)
Average daily hot water use (litres/day)												95.3643 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.9007	101.0862	97.2716	93.4570	89.6424	85.8279	85.8279	89.6424	93.4570	97.2716	101.0862	104.9007 (44)
Energy content (annual)	155.5647	136.0579	140.3996	122.4038	117.4493	101.3498	93.9155	107.7694	109.0565	127.0949	138.7340	150.6561 (45)
Distribution loss (46)m = 0.15 x (45)m												1500.4517 (45)
Water storage loss:	23.3347	20.4087	21.0599	18.3606	17.6174	15.2025	14.0873	16.1654	16.3585	19.0642	20.8101	22.5984 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Combi loss	16.9398	15.2965	16.9227	16.3609	16.8946	16.3362	16.8724	16.8868	16.3496	16.9111	16.3828	16.9354 (61)
Total heat required for water heating calculated for each month	172.5046	151.3544	157.3223	138.7646	134.3439	117.6860	110.7879	124.6562	125.4062	144.0060	155.1168	167.5916 (62)
WWHRS	-40.1211	-35.3008	-36.0294	-29.6481	-27.5310	-22.7133	-19.2258	-23.2770	-23.9548	-29.6099	-34.2949	-38.7779 eq. (G10)
Total of WWHRS savings												-360.4839
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)
Output from w/h	132.3835	116.0536	121.2930	109.1165	106.8129	94.9727	91.5621	101.3792	101.4513	114.3961	120.8218	128.8137 (64)
Heat gains from water heating, kWh/month	55.9602	49.0634	50.9135	44.7895	43.2755	37.7829	35.4450	40.0550	40.3487	46.4868	50.2247	54.3270 (65)
												1339.0565 (64)

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	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.7335	18.4153	14.9763	11.3380	8.4753	7.1552	7.7315	10.0496	13.4886	17.1269	19.9896	21.3097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5663	234.9796	228.8982	215.9514	199.6085	184.2485	173.9871	171.5738	177.6552	190.6019	206.9449	222.3049 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767 (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)	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135 (71)
Water heating gains (Table 5)	75.2154	73.0110	68.4322	62.2076	58.1661	52.4762	47.6411	53.8374	56.0399	62.4823	69.7566	73.0202 (72)
Total internal gains	393.1452	391.0360	376.9367	354.1271	330.8800	308.5100	293.9897	300.0909	311.8138	334.8412	361.3211	381.2649 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North				0.9600	10.6334		0.6300		0.7000	0.7700	3.1197 (74)	
South				14.2900	46.7521		0.6300		0.7000	0.7700	204.1761 (78)	
West				10.7700	19.6403		0.6300		0.7000	0.7700	64.6450 (80)	
Horizontal				1.4400	26.0000		0.6300		0.7000	1.0000	14.8599 (82)	

Solar gains	286.8007	497.6720	699.2094	887.1553	1005.5610	1001.6124	964.4183	876.8308	765.0785	555.5415	345.3322	244.1908 (83)
Total gains	679.9459	888.7079	1076.1462	1241.2825	1336.4409	1310.1224	1258.4080	1176.9216	1076.8923	890.3827	706.6534	625.4557 (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	43.1989	43.2689	43.3377	43.6638	43.7253	44.0142	44.0142	44.0681	43.9025	43.7253	43.6010	43.4717
alpha	3.8799	3.8846	3.8892	3.9109	3.9150	3.9343	3.9343	3.9379	3.9268	3.9150	3.9067	3.8981
util living area	0.9940	0.9831	0.9571	0.8944	0.7784	0.6148	0.4634	0.5111	0.7417	0.9345	0.9871	0.9956 (86)
MIT	19.3497	19.6345	20.0167	20.4422	20.7609	20.9311	20.9823	20.9741	20.8534	20.3997	19.7764	19.2943 (87)
Th 2	19.6078	19.6097	19.6116	19.6204	19.6220	19.6297	19.6297	19.6311	19.6267	19.6220	19.6187	19.6152 (88)
util rest of house	0.9919	0.9773	0.9425	0.8589	0.7081	0.5037	0.3259	0.3695	0.6392	0.9041	0.9817	0.9940 (89)
MIT 2	17.4728	17.8857	18.4310	19.0179	19.4123	19.5901	19.6245	19.6225	19.5262	18.9816	18.1011	17.3969 (90)
Living area fraction									fLA = Living area / (4) =			0.1511 (91)
MIT	17.7564	18.1500	18.6707	19.2332	19.6161	19.7928	19.8297	19.8268	19.7268	19.1960	18.3543	17.6837 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6064	18.0000	18.5207	19.0832	19.4661	19.6428	19.6797	19.6768	19.5768	19.0460	18.2043	17.5337 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9869	0.9674	0.9268	0.8417	0.6990	0.5048	0.3312	0.3745	0.6349	0.8868	0.9731	0.9902 (94)
Useful gains	671.0477	859.7265	997.3235	1044.7603	934.1201	661.4088	416.7394	440.7003	683.6756	789.5734	687.6482	619.3096 (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	1851.1591	1819.4981	1666.9284	1401.5790	1067.3926	688.5425	420.5081	446.8707	749.7031	1160.8342	1530.5552	1843.3104 (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	878.0029	644.9665	498.1861	256.9095	99.1548	0.0000	0.0000	0.0000	0.0000	276.2180	606.8930	910.6566 (98)
Space heating												4170.9874 (98)
Space heating per m2												(98) / (4) = 48.1972 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													89.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4639.5855 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	878.0029	644.9665	498.1861	256.9095	99.1548	0.0000	0.0000	0.0000	0.0000	276.2180	606.8930	910.6566	(98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000	(210)
Space heating fuel (main heating system)	976.6439	717.4265	554.1558	285.7725	110.2945	0.0000	0.0000	0.0000	0.0000	307.2503	675.0757	1012.9662	(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 requirement	132.3835	116.0536	121.2930	109.1165	106.8129	94.9727	91.5621	101.3792	101.4513	114.3961	120.8218	128.8137	(64)
Efficiency of water heater (217)m	89.4673	89.3968	89.2550	88.9216	88.2116	86.7000	86.7000	86.7000	86.7000	88.9386	89.3525	86.7000	(216)
Fuel for water heating, kWh/month	147.9685	129.8185	135.8949	122.7109	121.0871	109.5418	105.6080	116.9310	117.0142	128.6236	135.2194	143.9409	(219)
Water heating fuel used												1514.3589	(219)
Annual totals kWh/year													
Space heating fuel - main system												4639.5855	(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)												366.1593	(232)
Total delivered energy for all uses												6595.1037	(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	4639.5855	0.2160	1002.1505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1514.3589	0.2160	327.1015	(264)
Space and water heating			1329.2520	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	366.1593	0.5190	190.0367	(268)
Total CO2, kg/year			1558.2137	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0100	(273)

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

DER			18.0100	ZC1
Total Floor Area		TFA	86.5400	
Assumed number of occupants		N	2.5753	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			15.9249	ZC2
CO2 emissions from cooking, equation (L16)			2.0893	ZC3
Total CO2 emissions			36.0242	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			36.0242	ZC8

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Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.6000 (2b)	= 134.0560 (1b) - (3b)
First floor	34.9800 (1c)	x 2.9000 (2c)	= 101.4420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.4980 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour				
										heating	heating							
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) =	0.1274 (8)	
Pressure test																Yes		
Measured/design AP50																	5.0000	
Infiltration rate																	0.3774 (18)	
Number of sides sheltered																	1 (19)	
Shelter factor															(20) = 1 - [0.075 x (19)] =		0.9250 (20)	
Infiltration rate adjusted to include shelter factor															(21) = (18) x (20) =		0.3491 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec						
	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	0.4451	0.4364	0.4276	0.3840	0.3753	0.3316	0.3316	0.3229	0.3491	0.3753	0.3927	0.4102	(22b)					
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841	(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)			20.5000	1.3258	27.1780		(27)					
TER Room Window (Uw = 1.70)			1.1300	1.5918	1.7987		(27a)					
Ground floor			51.1300	0.1300	6.6469		(28a)					
Exposed floor			0.4300	0.1300	0.0559		(28b)					
External wall	140.5300	20.5000	120.0300	0.1800	21.6054		(29a)					
Flat roof	34.9800	1.1300	33.8500	0.1300	4.4005		(30)					
Balcony roof	17.0000		17.0000	0.1300	2.2100		(30)					
Total net area of external elements Aum(A, m2)			244.0700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		63.8954		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							25.4630 (36)					
Total fabric heat loss						(33) + (36) =	89.3584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.5548	Feb 46.2559	Mar 45.9629	Apr 44.5867	May 44.3292	Jun 43.1307	Jul 43.1307	Aug 42.9087	Sep 43.5923	Oct 44.3292	Nov 44.8501	Dec 45.3946 (38)
Heat transfer coeff	135.9132	135.6143	135.3213	133.9451	133.6877	132.4891	132.4891	132.2671	132.9507	133.6877	134.2085	134.7531 (39)
Average = Sum(39)m / 12 =												133.9439 (39)
HLP	Jan 1.5705	Feb 1.5671	Mar 1.5637	Apr 1.5478	May 1.5448	Jun 1.5310	Jul 1.5310	Aug 1.5284	Sep 1.5363	Oct 1.5448	Nov 1.5508	Dec 1.5571 (40)
HLP (average)												1.5478 (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												2.5753 (42)
Average daily hot water use (litres/day)												95.3643 (43)
Daily hot water use	Jan 104.9007	Feb 101.0862	Mar 97.2716	Apr 93.4570	May 89.6424	Jun 85.8279	Jul 85.8279	Aug 89.6424	Sep 93.4570	Oct 97.2716	Nov 101.0862	Dec 104.9007 (44)
Energy conte	155.5647	136.0579	140.3996	122.4038	117.4493	101.3498	93.9155	107.7694	109.0565	127.0949	138.7340	150.6561 (45)
Energy content (annual)												1500.4517 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.3347	20.4087	21.0599	18.3606	17.6174	15.2025	14.0873	16.1654	16.3585	19.0642	20.8101	22.5984 (46)	
Water storage loss:												
Total storage loss												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 (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)
Combi loss	50.9589	46.0274	49.5685	46.0884	45.6808	42.3261	43.7369	45.6808	46.0884	49.5685	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150 (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)
Output from w/h	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150 (64)
Heat gains from water heating, kWh/month	64.4650	56.7461	59.0750	52.2213	50.4721	44.2803	42.1611	47.2535	47.7834	54.6512	58.4578	62.8329 (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	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.7335	18.4153	14.9763	11.3380	8.4753	7.1552	7.7315	10.0496	13.4886	17.1269	19.9896	21.3097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5663	234.9796	228.8982	215.9514	199.6085	184.2485	173.9871	171.5738	177.6552	190.6019	206.9449	222.3049	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	(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)	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	(71)
Water heating gains (Table 5)	86.6465	84.4436	79.4019	72.5296	67.8388	61.5005	56.6682	63.5128	66.3658	73.4559	81.1914	84.4528	(72)
Total internal gains	404.5764	402.4686	387.9064	364.4492	340.5528	317.5343	303.0168	309.7663	322.1397	345.8148	372.7560	392.6975	(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			0.7600		10.6334		0.6300		0.7000		0.7700		2.4698 (74)
South			11.2500		46.7521		0.6300		0.7000		0.7700		160.7404 (78)
West			8.4900		19.6403		0.6300		0.7000		0.7700		50.9597 (80)
Horizontal			1.1300		26.0000		0.6300		0.7000		1.0000		11.6609 (82)
Solar gains	225.8308	391.8781	550.5834	698.5940	791.8454	788.7412	759.4498	690.4688	602.4564	437.4487	271.9202	192.2787	(83)
Total gains	630.4072	794.3467	938.4898	1063.0432	1132.3982	1106.2755	1062.4666	1000.2351	924.5961	783.2635	644.6761	584.9761	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	44.2174	44.3148	44.4108	44.8670	44.9535	45.3601	45.3601	45.4363	45.2026	44.9535	44.7790	44.5980	
alpha	3.9478	3.9543	3.9607	3.9911	3.9969	4.0240	4.0240	4.0291	4.0135	3.9969	3.9853	3.9732	
util living area	0.9954	0.9882	0.9712	0.9272	0.8354	0.6832	0.5254	0.5733	0.7974	0.9533	0.9905	0.9966	(86)
MIT	19.3446	19.5896	19.9396	20.3574	20.6990	20.9065	20.9749	20.9644	20.8174	20.3483	19.7591	19.3018	(87)
Th 2	19.6350	19.6376	19.6401	19.6519	19.6541	19.6644	19.6644	19.6663	19.6604	19.6541	19.6496	19.6449	(88)
util rest of house	0.9938	0.9842	0.9608	0.9001	0.7740	0.5718	0.3772	0.4235	0.7027	0.9301	0.9864	0.9953	(89)
MIT 2	17.4828	17.8399	18.3446	18.9355	19.3769	19.6073	19.6565	19.6537	19.5274	18.9395	18.0967	17.4268	(90)
Living area fraction	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(91)
MIT	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(92)
Temperature adjustment	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(93)
adjusted MIT	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9772	0.9496	0.8872	0.7698	0.5846	0.3995	0.4457	0.7078	0.9182	0.9804	0.9925	(94)
Useful gains	624.2228	776.2631	891.1547	943.1840	871.7304	646.7148	424.4706	445.8225	654.4727	719.1894	632.0537	580.5978	(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	1829.9617	1790.7038	1635.4472	1372.9966	1053.0191	689.4249	431.3576	456.5600	747.5000	1143.3512	1509.5691	1820.5383	(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	897.0697	681.7041	553.7537	309.4651	134.8788	0.0000	0.0000	0.0000	0.0000	315.5764	631.8111	922.5157	(98)
Space heating												4446.7744	(98)
Space heating per m2												51.3840	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4761.0004 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	897.0697	681.7041	553.7537	309.4651	134.8788	0.0000	0.0000	0.0000	0.0000	315.5764	631.8111	922.5157	(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)	960.4601	729.8759	592.8840	331.3330	144.4098	0.0000	0.0000	0.0000	0.0000	337.8762	676.4572	987.7041	(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 requirement	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150	(64)
Efficiency of water heater (217)m	88.3211	88.0651	87.5861	86.5618	84.5768	80.3000	80.3000	80.3000	80.3000	86.4955	87.8651	88.4057	(216)
Fuel for water heating, kWh/month	233.8327	206.7623	216.8930	194.6494	192.8781	178.9239	171.4227	191.0962	193.2066	204.2459	214.0201	228.0566	(219)
Water heating fuel used												2425.9876	(219)
Annual totals kWh/year													
Space heating fuel - main system												4761.0004	(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)												366.1593	(232)
Total delivered energy for all uses												7628.1474	(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	4761.0004	0.2160	1028.3761 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2425.9876	0.2160	524.0133 (264)
Space and water heating			1552.3894 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	366.1593	0.5190	190.0367 (268)
Total CO2, kg/m2/year			1781.3511 (272)
Emissions per m2 for space and water heating			17.9384 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1959 (272b)
Emissions per m2 for pumps and fans			0.4498 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9384 * 1.00) + 2.1959 + 0.4498, rounded to 2 d.p.			20.5800 (273)

Appendix C SAP Worksheet Be Green

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	S10920 01			Issued on Date	06/04/2023
Assessment Reference	Be green	Prop Type Ref			
Property	Denmark Street, N17 0JL				
SAP Rating	96 A	DER	5.89	TER	20.58
Environmental	96 A	% DER<TER	71.39		
CO ₂ Emissions (t/year)	0.12	DFEE	58.38	TFEE	67.49
General Requirements Compliance	Pass	% DFEE<TFEE	13.50		
Assessor Details	Mr. Peter Kinsella, Base Energy Services Ltd, Tel: 0151 933 0328, peter@baseenergy.co.uk			Assessor ID	L770-0002
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 87 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) 20.58 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 5.89 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)67.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)58.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Assure 30 Combi
Combi boiler
Efficiency: 89.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

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): Slight OK
Based on:
Overshading: Average
Windows facing North: 0.96 m², No overhang
Windows facing South: 14.29 m², No overhang
Windows facing West: 10.77 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Floor U-value 0.11 W/m²K
Exposed floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Photovoltaic array 2.40 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.6000 (2b)	= 134.0560 (1b) - (3b)
First floor	34.9800 (1c)	x 2.9000 (2c)	= 101.4420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.4980 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	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)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1274 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.3274 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3028 (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	0.3861	0.3785	0.3710	0.3331	0.3255	0.2877	0.2877	0.2801	0.3028	0.3255	0.3407	0.3558 (22b)
Effective ac	0.5745	0.5716	0.5688	0.5555	0.5530	0.5414	0.5414	0.5392	0.5459	0.5530	0.5580	0.5633 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Windows (Uw = 1.40)			26.0200	1.3258	34.4962		(27)
Roof light (Uw = 1.40)			1.4400	1.3258	1.9091		(27a)
Ground floor			51.1300	0.1100	5.6243		(28a)
Exposed floor			0.4300	0.1100	0.0473		(28b)
External wall	140.5300	26.0200	114.5100	0.1800	20.6118		(29a)
Flat roof	34.9800	1.4400	33.5400	0.1300	4.3602		(30)
Balcony roof	17.0000		17.0000	0.1300	2.2100		(30)
Total net area of external elements Aum(A, m ²)			244.0700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		69.2589		(33)
Party Wall 1			13.2300	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6802 (36)
Total fabric heat loss						(33) + (36) =	96.9391 (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	44.6502	44.4252	44.2047	43.1691	42.9753	42.0733	42.0733	41.9062	42.4207	42.9753	43.3673	43.7771 (38)
Heat transfer coeff	141.5893	141.3643	141.1438	140.1082	139.9144	139.0124	139.0124	138.8453	139.3598	139.9144	140.3064	140.7162 (39)
Average = Sum(39)m / 12 =												140.1073 (39)
HLP	1.6361	1.6335	1.6310	1.6190	1.6168	1.6063	1.6063	1.6044	1.6104	1.6168	1.6213	1.6260 (40)
HLP (average)												1.6190 (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												2.5753 (42)
Average daily hot water use (litres/day)												95.3643 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.9007	101.0862	97.2716	93.4570	89.6424	85.8279	85.8279	89.6424	93.4570	97.2716	101.0862	104.9007 (44)
Energy conte	155.5647	136.0579	140.3996	122.4038	117.4493	101.3498	93.9155	107.7694	109.0565	127.0949	138.7340	150.6561 (45)
Energy content (annual)												Total = Sum(45)m = 1500.4517 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.3347	20.4087	21.0599	18.3606	17.6174	15.2025	14.0873	16.1654	16.3585	19.0642	20.8101	22.5984 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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)
Combi loss	16.9398	15.2965	16.9227	16.3609	16.8946	16.3362	16.8724	16.8868	16.3496	16.9111	16.3828	16.9354 (61)
Total heat required for water heating calculated for each month	172.5046	151.3544	157.3223	138.7646	134.3439	117.6860	110.7879	124.6562	125.4062	144.0060	155.1168	167.5916 (62)
WWHRS	-40.1211	-35.3008	-36.0294	-29.6481	-27.5310	-22.7133	-19.2258	-23.2770	-23.9548	-29.6099	-34.2949	-38.7779 eq. (G10)
Total of WWHRS savings												-360.4839
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)
Output from w/h	132.3835	116.0536	121.2930	109.1165	106.8129	94.9727	91.5621	101.3792	101.4513	114.3961	120.8218	128.8137 (64)
Heat gains from water heating, kWh/month	55.9602	49.0634	50.9135	44.7895	43.2755	37.7829	35.4450	40.0550	40.3487	46.4868	50.2247	54.3270 (65)
Total per year (kWh/year) = Sum(63)m = 0.0000 (63)												

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	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.7335	18.4153	14.9763	11.3380	8.4753	7.1552	7.7315	10.0496	13.4886	17.1269	19.9896	21.3097 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5663	234.9796	228.8982	215.9514	199.6085	184.2485	173.9871	171.5738	177.6552	190.6019	206.9449	222.3049 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767 (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)	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135 (71)
Water heating gains (Table 5)	75.2154	73.0110	68.4322	62.2076	58.1661	52.4762	47.6411	53.8374	56.0399	62.4823	69.7566	73.0202 (72)
Total internal gains	393.1452	391.0360	376.9367	354.1271	330.8800	308.5100	293.9897	300.0909	311.8138	334.8412	361.3211	381.2649 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
North					0.9600	10.6334		0.6300		0.7000	0.7700		3.1197 (74)
South					14.2900	46.7521		0.6300		0.7000	0.7700		204.1761 (78)
West					10.7700	19.6403		0.6300		0.7000	0.7700		64.6450 (80)
Horizontal					1.4400	26.0000		0.6300		0.7000	1.0000		14.8599 (82)

Solar gains	286.8007	497.6720	699.2094	887.1553	1005.5610	1001.6124	964.4183	876.8308	765.0785	555.5415	345.3322		244.1908 (83)
Total gains	679.9459	888.7079	1076.1462	1241.2825	1336.4409	1310.1224	1258.4080	1176.9216	1076.8923	890.3827	706.6534		625.4557 (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	42.4448	42.5123	42.5787	42.8934	42.9528	43.2316	43.2316	43.2836	43.1238	42.9528	42.8328	42.7081
alpha	3.8297	3.8342	3.8386	3.8596	3.8635	3.8821	3.8821	3.8856	3.8749	3.8635	3.8555	3.8472
util living area	0.9940	0.9833	0.9579	0.8969	0.7836	0.6219	0.4704	0.5184	0.7476	0.9359	0.9872	0.9956 (86)
MIT	19.3164	19.6015	19.9865	20.4181	20.7460	20.9250	20.9803	20.9713	20.8433	20.3781	19.7480	19.2610 (87)
Th 2	19.5870	19.5888	19.5907	19.5994	19.6011	19.6087	19.6087	19.6101	19.6058	19.6011	19.5978	19.5943 (88)
util rest of house	0.9918	0.9775	0.9434	0.8617	0.7132	0.5090	0.3293	0.3733	0.6444	0.9058	0.9818	0.9940 (89)
MIT 2	17.4112	17.8246	18.3742	18.9706	19.3779	19.5656	19.6030	19.6007	19.4982	18.9376	18.0465	17.3352 (90)
Living area fraction	17.6991	18.0931	18.6179	19.1893	19.5847	19.7710	19.8111	19.8078	19.7015	19.1554	18.3037	17.6263 (92)
MIT	17.6991	18.0931	18.6179	19.1893	19.5847	19.7710	19.8111	19.8078	19.7015	19.1554	18.3037	17.6263 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5491	17.9431	18.4679	19.0393	19.4347	19.6210	19.6611	19.6578	19.5515	19.0054	18.1537	17.4763 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9868	0.9675	0.9275	0.8441	0.7035	0.5101	0.3348	0.3785	0.6397	0.8882	0.9731	0.9901 (94)
Ext temp.	670.9854	859.8174	998.1500	1047.7476	940.2149	668.3166	421.3307	445.4930	688.8923	790.8559	687.6618	619.2465 (95)
Heat loss rate W	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)
Month fracti	1875.9346	1843.8335	1689.1916	1420.6050	1082.1966	697.9868	425.5366	452.3362	759.7161	1176.0308	1550.9057	1868.1862 (97)
Space heating kWh	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	896.4822	661.2588	514.1350	268.4573	105.6343	0.0000	0.0000	0.0000	0.0000	286.5702	621.5356	929.2111 (98)
Space heating per m2												4283.2845 (98)
(98) / (4) = 49.4949 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)												89.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4764.4989 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	896.4822	661.2588	514.1350	268.4573	105.6343	0.0000	0.0000	0.0000	0.0000	286.5702	621.5356	929.2111 (98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000 (210)
Space heating fuel (main heating system)	997.1993	735.5493	571.8965	298.6177	117.5020	0.0000	0.0000	0.0000	0.0000	318.7655	691.3633	1033.6053 (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 requirement	132.3835	116.0536	121.2930	109.1165	106.8129	94.9727	91.5621	101.3792	101.4513	114.3961	120.8218	128.8137 (64)
Efficiency of water heater (217)m	89.4751	89.4073	89.2711	88.9512	88.2621	86.7000	86.7000	86.7000	86.7000	88.9632	89.3632	86.7000 (216)
Fuel for water heating, kWh/month	147.9557	129.8033	135.8704	122.6701	121.0178	109.5418	105.6080	116.9310	117.0142	128.5881	135.2031	89.4978 (217)
Water heating fuel used												143.9294 (219)
Annual totals kWh/year												1514.1329 (219)
Space heating fuel - main system												4764.4989 (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)												366.1593 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.40 * 1080 * 1.00) =									-2072.6873			-2072.6873 (233)
Total delivered energy for all uses												4647.1039 (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	4764.4989	0.2160	1029.1318 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1514.1329	0.2160	327.0527 (264)
Space and water heating			1356.1845 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	366.1593	0.5190	190.0367 (268)
Energy saving/generation technologies			
PV Unit	-2072.6873	0.5190	-1075.7247 (269)
Total CO2, kg/year			509.4215 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			5.8900 (273)

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

DER		5.8900 ZC1
Total Floor Area	TFA	86.5400
Assumed number of occupants	N	2.5753
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.9249 ZC2
CO2 emissions from cooking, equation (L16)		2.0893 ZC3
Total CO2 emissions		23.9042 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		23.9042 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.6000 (2b)	= 134.0560 (1b) - (3b)
First floor	34.9800 (1c)	x 2.9000 (2c)	= 101.4420 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 235.4980 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
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) =	0.1274 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3774 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3491 (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	0.4451	0.4364	0.4276	0.3840	0.3753	0.3316	0.3316	0.3229	0.3491	0.3753	0.3927	0.4102	(22b)				
Effective ac	0.5990	0.5952	0.5914	0.5737	0.5704	0.5550	0.5550	0.5521	0.5609	0.5704	0.5771	0.5841	(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)			20.5000	1.3258	27.1780		(27)					
TER Room Window (Uw = 1.70)			1.1300	1.5918	1.7987		(27a)					
Ground floor			51.1300	0.1300	6.6469		(28a)					
Exposed floor			0.4300	0.1300	0.0559		(28b)					
External wall	140.5300	20.5000	120.0300	0.1800	21.6054		(29a)					
Flat roof	34.9800	1.1300	33.8500	0.1300	4.4005		(30)					
Balcony roof	17.0000		17.0000	0.1300	2.2100		(30)					
Total net area of external elements Aum(A, m2)			244.0700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		63.8954		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							25.4630 (36)					
Total fabric heat loss						(33) + (36) =	89.3584 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 46.5548	Feb 46.2559	Mar 45.9629	Apr 44.5867	May 44.3292	Jun 43.1307	Jul 43.1307	Aug 42.9087	Sep 43.5923	Oct 44.3292	Nov 44.8501	Dec 45.3946 (38)
Heat transfer coeff	135.9132	135.6143	135.3213	133.9451	133.6877	132.4891	132.4891	132.2671	132.9507	133.6877	134.2085	134.7531 (39)
Average = Sum(39)m / 12 =												133.9439 (39)
HLP	Jan 1.5705	Feb 1.5671	Mar 1.5637	Apr 1.5478	May 1.5448	Jun 1.5310	Jul 1.5310	Aug 1.5284	Sep 1.5363	Oct 1.5448	Nov 1.5508	Dec 1.5571 (40)
HLP (average)												1.5478 (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												2.5753 (42)
Average daily hot water use (litres/day)												95.3643 (43)
Daily hot water use	Jan 104.9007	Feb 101.0862	Mar 97.2716	Apr 93.4570	May 89.6424	Jun 85.8279	Jul 85.8279	Aug 89.6424	Sep 93.4570	Oct 97.2716	Nov 101.0862	Dec 104.9007 (44)
Energy conte	155.5647	136.0579	140.3996	122.4038	117.4493	101.3498	93.9155	107.7694	109.0565	127.0949	138.7340	150.6561 (45)
Energy content (annual)												1500.4517 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.3347	20.4087	21.0599	18.3606	17.6174	15.2025	14.0873	16.1654	16.3585	19.0642	20.8101	22.5984 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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 (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)
Combi loss	50.9589	46.0274	49.5685	46.0884	45.6808	42.3261	43.7369	45.6808	46.0884	49.5685	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150 (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)
Output from w/h	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150 (64)
Heat gains from water heating, kWh/month	64.4650	56.7461	59.0750	52.2213	50.4721	44.2803	42.1611	47.2535	47.7834	54.6512	58.4578	62.8329 (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	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	128.7669	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.7335	18.4153	14.9763	11.3380	8.4753	7.1552	7.7315	10.0496	13.4886	17.1269	19.9896	21.3097	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.5663	234.9796	228.8982	215.9514	199.6085	184.2485	173.9871	171.5738	177.6552	190.6019	206.9449	222.3049	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	35.8767	(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)	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	-103.0135	(71)
Water heating gains (Table 5)	86.6465	84.4436	79.4019	72.5296	67.8388	61.5005	56.6682	63.5128	66.3658	73.4559	81.1914	84.4528	(72)
Total internal gains	404.5764	402.4686	387.9064	364.4492	340.5528	317.5343	303.0168	309.7663	322.1397	345.8148	372.7560	392.6975	(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					0.7600	10.6334	0.6300	0.7000	0.7700				2.4698 (74)
South					11.2500	46.7521	0.6300	0.7000	0.7700				160.7404 (78)
West					8.4900	19.6403	0.6300	0.7000	0.7700				50.9597 (80)
Horizontal					1.1300	26.0000	0.6300	0.7000	1.0000				11.6609 (82)

Solar gains	225.8308	391.8781	550.5834	698.5940	791.8454	788.7412	759.4498	690.4688	602.4564	437.4487	271.9202	192.2787	(83)
Total gains	630.4072	794.3467	938.4898	1063.0432	1132.3982	1106.2755	1062.4666	1000.2351	924.5961	783.2635	644.6761	584.9761	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	44.2174	44.3148	44.4108	44.8670	44.9535	45.3601	45.3601	45.4363	45.2026	44.9535	44.7790	44.5980	
alpha	3.9478	3.9543	3.9607	3.9911	3.9969	4.0240	4.0240	4.0291	4.0135	3.9969	3.9853	3.9732	
util living area	0.9954	0.9882	0.9712	0.9272	0.8354	0.6832	0.5254	0.5733	0.7974	0.9533	0.9905	0.9966	(86)
MIT	19.3446	19.5896	19.9396	20.3574	20.6990	20.9065	20.9749	20.9644	20.8174	20.3483	19.7591	19.3018	(87)
Th 2	19.6350	19.6376	19.6401	19.6519	19.6541	19.6644	19.6644	19.6663	19.6604	19.6541	19.6496	19.6449	(88)
util rest of house	0.9938	0.9842	0.9608	0.9001	0.7740	0.5718	0.3772	0.4235	0.7027	0.9301	0.9864	0.9953	(89)
MIT 2	17.4828	17.8399	18.3446	18.9355	19.3769	19.6073	19.6565	19.6537	19.5274	18.9395	18.0967	17.4268	(90)
Living area fraction	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(91)
MIT	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(92)
Temperature adjustment	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(93)
adjusted MIT	17.7642	18.1044	18.5857	19.1504	19.5767	19.8036	19.8558	19.8518	19.7224	19.1524	18.3479	17.7102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9902	0.9772	0.9496	0.8872	0.7698	0.5846	0.3995	0.4457	0.7078	0.9182	0.9804	0.9925	(94)
Useful gains	624.2228	776.2631	891.1547	943.1840	871.7304	646.7148	424.4706	445.8225	654.4727	719.1894	632.0537	580.5978	(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	1829.9617	1790.7038	1635.4472	1372.9966	1053.0191	689.4249	431.3576	456.5600	747.5000	1143.3512	1509.5691	1820.5383	(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	897.0697	681.7041	553.7537	309.4651	134.8788	0.0000	0.0000	0.0000	0.0000	315.5764	631.8111	922.5157	(98)
Space heating												4446.7744	(98)
Space heating per m2												51.3840	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4761.0004 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	897.0697	681.7041	553.7537	309.4651	134.8788	0.0000	0.0000	0.0000	0.0000	315.5764	631.8111	922.5157	(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)	960.4601	729.8759	592.8840	331.3330	144.4098	0.0000	0.0000	0.0000	0.0000	337.8762	676.4572	987.7041	(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 requirement	206.5236	182.0853	189.9681	168.4921	163.1301	143.6759	137.6525	153.4502	155.1449	176.6634	188.0491	201.6150	(64)
Efficiency of water heater (217)m	88.3211	88.0651	87.5861	86.5618	84.5768	80.3000	80.3000	80.3000	80.3000	86.4955	87.8651	88.4057	(216)
Fuel for water heating, kWh/month	233.8327	206.7623	216.8930	194.6494	192.8781	178.9239	171.4227	191.0962	193.2066	204.2459	214.0201	228.0566	(219)
Water heating fuel used												2425.9876	(219)
Annual totals kWh/year													
Space heating fuel - main system												4761.0004	(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)												366.1593	(232)
Total delivered energy for all uses												7628.1474	(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	4761.0004	0.2160	1028.3761 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2425.9876	0.2160	524.0133 (264)
Space and water heating			1552.3894 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	366.1593	0.5190	190.0367 (268)
Total CO2, kg/m2/year			1781.3511 (272)
Emissions per m2 for space and water heating			17.9384 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1959 (272b)
Emissions per m2 for pumps and fans			0.4498 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.9384 * 1.00) + 2.1959 + 0.4498, rounded to 2 d.p.			20.5800 (273)