

Sustainability Statement for Planning

Client: Atlas Property London

Site: 18 Denmark Street
London
N17 0JL

Proposals: The construction of 5 new terrace houses over two storeys.

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Report Details:

Assessor	Checked	Date	Job
CT	PK	08/02/2024	Rev0

This document has been prepared solely as a Sustainable Statement for Atlas Property London Base Energy Services Ltd. accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

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 5 new terrace houses over two storeys.

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.

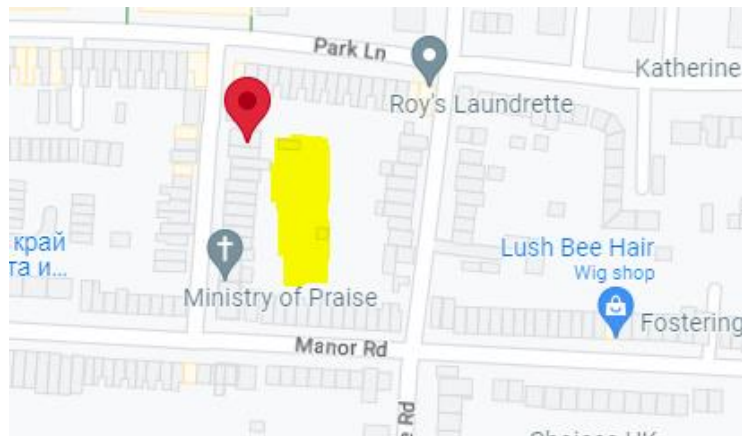


Figure 1: Site Location

4 – Sustainability Statement

Energy	
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 0.15W/m2k, Floor 0.10W/m2k, Roof 0.12W/m2k windows 1.2W/m2k • High efficiency ASHP heating system • Time and temperature zone control, • Mechanical Ventilations with heat recovery

	This has shown to be an improvement over building regulations Part L1a 2013 baseline, by achieving a potential of 93% improvement in CO2 emissions, which equates to a saving of 7,987Kg/year CO2. The development CO2 emissions further using SAP 10 carbon factors. With the addition on the ASHP and solar PV is shows a potential improvement of 97% improvement in CO2 emissions which quates to 7,493 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 5 new terrace houses over two storeys.

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 93% improvement
- When using the SAP 10 GLA spread sheet this is shown to be a 97% improvement in CO2 emissions.
- 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.

- KEY
- 1. Sloped Pathway from street level
 - 2. New paving throughout
 - 3. Indicative position of mains inlet
 - 4. Planting
 - 5. Private amenity space for Flat A
 - 6. Communal brick bench seat
 - 7. Communal playground
 - 8. Indicative position of mains outlet
 - 9. Planting
 - 10. Bollard light
 - 11. General Waste & Recycling bins store
 - 12. Bicycle store
 - 13. New Boundary fence
 - 14. Private amenity space
 - 15. 1.2m high boundary wall and gate to Unit 5
 - 16. Unit 5 planting space
 - 17. New boundary masonry wall
 - 18. 100l rainwater tank
 - 19. Air Source Heat Pump Cylinder
 - 20. Hybrid MVHR Unit

PLANNING

Project No. 2210

Client Atlas Property London Ltd

Date Mar 23

Scale 1:200 @ A3 / 1:100@A1

Project 18, Denmark Street, N17 0JL

Drawing Title: Proposed Site Plan - Ground Floor

Drawing No. 2210_10_PL_10 Rev. C

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.

Denmark Street



Appendix B SAP Worksheet Baseline/Be Lean

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	S11818 01			Issued on Date	21/02/2024
Assessment Reference	Be lean	Prop Type Ref			
Property	Denmark Street, N17 0JL				
SAP Rating	85 B	DER	14.87	TER	20.61
Environmental	88 B	% DER<TER	27.86		
CO ₂ Emissions (t/year)	1.03	DFEE	43.29	TFEE	67.71
General Requirements Compliance	Pass	% DFEE<TFEE	36.07		
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) 20.61 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.87 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 67.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 43.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

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

3 Air permeability

Air permeability at 50 pascals: 3.00 (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

Continuous supply and extract system
Specific fan power: 0.80
Maximum 1.5 OK
MVHR efficiency: 87%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing South: 9.89 m², No overhang
Windows facing West: 7.80 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.12 W/m²K
Roof U-value 0.12 W/m²K
Floor U-value 0.10 W/m²K
Exposed floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (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) =		0.1388 (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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												60.9000 (23c)
Effective ac	0.3724	0.3689	0.3655	0.3481	0.3447	0.3273	0.3273	0.3238	0.3343	0.3447	0.3516	0.3585 (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 = 1.20)			18.7700	1.1450	21.4924		(27)
Roof light (Uw = 1.20)			2.2800	1.1450	2.6107		(27a)
Ground floor			51.1300	0.1000	5.1130		(28a)
Exposed floor			0.4300	0.1000	0.0430		(28b)
External wall	140.5300	18.7700	121.7600	0.1500	18.2640		(29a)
Flat roof	34.9800	2.2800	32.7000	0.1200	3.9240		(30)
Balcony roof	17.0000		17.0000	0.1200	2.0400		(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) =		53.4871		(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 (User defined value 0.050 * total exposed area)							12.2035 (36)
Total fabric heat loss						(33) + (36) =	65.6906 (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	28.9413	28.6717	28.4022	27.0543	26.7847	25.4369	25.4369	25.1673	25.9760	26.7847	27.3239	27.8630 (38)
Heat transfer coeff	94.6319	94.3623	94.0927	92.7449	92.4753	91.1274	91.1274	90.8579	91.6666	92.4753	93.0144	93.5536 (39)
Average = Sum(39)m / 12 =												92.6775 (39)
HLP	1.0935	1.0904	1.0873	1.0717	1.0686	1.0530	1.0530	1.0499	1.0592	1.0686	1.0748	1.0810 (40)
HLP (average)												1.0709 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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:												
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	(63)
Solar input (sum of months) = Sum (63)m =												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)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
128.7669	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	(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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.0800	10.6334	0.6300	0.7000	0.7700	3.5097 (74)			
South				9.8900	46.7521	0.6300	0.7000	0.7700	141.3087 (78)			
West				7.8000	19.6403	0.6300	0.7000	0.7700	46.8181 (80)			
Horizontal				2.2800	26.0000	0.6300	0.7000	1.0000	23.5282 (82)			

Solar gains	215.1647	378.5869	543.8972	707.2070	815.1953	817.4902	784.8836	704.3608	601.1415	426.0002	260.0681	182.5341 (83)
Total gains	608.3099	769.6228	920.8339	1061.3341	1146.0753	1126.0002	1078.8734	1004.4517	912.9553	760.8414	621.3892	563.7989 (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	63.5063	63.6878	63.8702	64.7984	64.9873	65.9486	65.9486	66.1442	65.5607	64.9873	64.6106	64.2383
alpha	5.2338	5.2459	5.2580	5.3199	5.3325	5.3966	5.3966	5.4096	5.3707	5.3325	5.3074	5.2826
util living area	0.9958	0.9859	0.9550	0.8643	0.7020	0.5107	0.3705	0.4140	0.6600	0.9226	0.9893	0.9971 (86)
MIT	19.9314	20.1656	20.4677	20.7744	20.9390	20.9909	20.9987	20.9976	20.9669	20.7138	20.2538	19.8905 (87)
Th 2	20.0061	20.0087	20.0112	20.0240	20.0266	20.0394	20.0394	20.0420	20.0343	20.0266	20.0215	20.0163 (88)
util rest of house	0.9945	0.9815	0.9417	0.8296	0.6431	0.4373	0.2902	0.3289	0.5803	0.8934	0.9852	0.9962 (89)
MIT 2	18.5907	18.9315	19.3614	19.7802	19.9734	20.0340	20.0389	20.0411	20.0114	19.7168	19.0711	18.5386 (90)
Living area fraction												
MIT	18.7933	19.1181	19.5286	19.9305	20.1193	20.1786	20.1840	20.1857	20.1558	19.8675	19.2499	18.7429 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6433	18.9681	19.3786	19.7805	19.9693	20.0286	20.0340	20.0357	20.0058	19.7175	19.0999	18.5929 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9917	0.9751	0.9309	0.8198	0.6394	0.4364	0.2898	0.3283	0.5779	0.8820	0.9797	0.9941 (94)
Useful gains	603.2450	750.4597	857.2351	870.0665	732.8315	491.4046	312.6517	329.7867	527.5616	671.0257	608.7717	560.4869 (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	1357.3348	1327.4940	1211.7811	1009.1074	764.7087	494.6980	312.9310	330.3279	541.3659	843.1408	1116.1632	1346.5115 (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	561.0428	387.7671	263.7822	100.1095	23.7166	0.0000	0.0000	0.0000	0.0000	128.0536	365.3219	584.8023 (98)
Space heating												2414.5960 (98)
Space heating per m2												(98) / (4) = 27.9015 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													89.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2685.8687 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	561.0428	387.7671	263.7822	100.1095	23.7166	0.0000	0.0000	0.0000	0.0000	128.0536	365.3219	584.8023	(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)	624.0743	431.3316	293.4174	111.3565	26.3811	0.0000	0.0000	0.0000	0.0000	142.4401	406.3647	650.5031	(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	89.2710	89.1421	88.8669	88.2022	87.2644	86.7000	86.7000	86.7000	86.7000	88.3612	89.0828	86.7000	(216)
Fuel for water heating, kWh/month	148.2940	130.1894	136.4884	123.7118	122.4015	109.5418	105.6080	116.9310	117.0142	129.4642	135.6286	144.2401	(219)
Water heating fuel used												1519.5131	(219)
Annual totals kWh/year													
Space heating fuel - main system												2685.8687	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)													
mechanical ventilation fans (SFP = 1.0000)													287.3076 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													362.3076 (231)
Electricity for lighting (calculated in Appendix L)													366.1593 (232)
Total delivered energy for all uses													4933.8487 (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	2685.8687	0.2160	580.1476	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1519.5131	0.2160	328.2148	(264)
Space and water heating			908.3625	(265)
Pumps and fans	362.3076	0.5190	188.0376	(267)
Energy for lighting	366.1593	0.5190	190.0367	(268)
Total CO2, kg/year			1286.4368	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8700	(273)

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

DER			14.8700	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			32.8842	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			32.8842	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)			18.7700	1.3258	24.8845		(27)					
TER Room Window (Uw = 1.70)			2.2800	1.5918	3.6292		(27a)					
Ground floor			51.1300	0.1300	6.6469		(28a)					
Exposed floor			0.4300	0.1300	0.0559		(28b)					
External wall	140.5300	18.7700	121.7600	0.1800	21.9168		(29a)					
Flat roof	34.9800	2.2800	32.7000	0.1300	4.2510		(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) =		63.5943		(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) =	89.0573 (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	135.6120	135.3131	135.0202	133.6440	133.3865	132.1879	132.1879	131.9660	132.6496	133.3865	133.9074	134.4519 (39)
Average = Sum(39)m / 12 =												133.6428 (39)
HLP	Jan 1.5670	Feb 1.5636	Mar 1.5602	Apr 1.5443	May 1.5413	Jun 1.5275	Jul 1.5275	Aug 1.5249	Sep 1.5328	Oct 1.5413	Nov 1.5473	Dec 1.5536 (40)
HLP (average)												1.5443 (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)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	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)												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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	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)
Total per year (kWh/year) = Sum(63)m = 2066.4504 (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)
(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					1.0800	10.6334	0.6300	0.7000	0.7700		3.5097 (74)	
South					9.8900	46.7521	0.6300	0.7000	0.7700		141.3087 (78)	
West					7.8000	19.6403	0.6300	0.7000	0.7700		46.8181 (80)	
Horizontal					2.2800	26.0000	0.6300	0.7000	1.0000		23.5282 (82)	

Solar gains	215.1647	378.5869	543.8972	707.2070	815.1953	817.4902	784.8836	704.3608	601.1415	426.0002	260.0681	182.5341 (83)
Total gains	619.7411	781.0555	931.8036	1071.6562	1155.7481	1135.0245	1087.9004	1014.1271	923.2812	771.8150	632.8240	575.2315 (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	44.3155	44.4134	44.5098	44.9681	45.0549	45.4635	45.4635	45.5399	45.3052	45.0549	44.8797	44.6979	
alpha	3.9544	3.9609	3.9673	3.9979	4.0037	4.0309	4.0309	4.0360	4.0203	4.0037	3.9920	3.9799	
util living area	0.9957	0.9889	0.9717	0.9253	0.8274	0.6702	0.5138	0.5658	0.7973	0.9552	0.9911	0.9968	(86)
MIT	19.3381	19.5809	19.9374	20.3667	20.7121	20.9133	20.9770	20.9663	20.8183	20.3415	19.7511	19.2962	(87)
Th 2	19.6376	19.6401	19.6426	19.6544	19.6566	19.6670	19.6670	19.6689	19.6630	19.6566	19.6522	19.6475	(88)
util rest of house	0.9941	0.9850	0.9616	0.8977	0.7647	0.5591	0.3683	0.4175	0.7027	0.9328	0.9873	0.9956	(89)
MIT 2	17.4751	17.8292	18.3433	18.9497	19.3932	19.6146	19.6598	19.6570	19.5306	18.9324	18.0869	17.4203	(90)
Living area fraction	17.7567	18.0939	18.5842	19.1639	19.5926	19.8109	19.8589	19.8549	19.7252	19.1454	18.3384	17.7038	(91)
MIT	17.7567	18.0939	18.5842	19.1639	19.5926	19.8109	19.8589	19.8549	19.7252	19.1454	18.3384	17.7038	(92)
Temperature adjustment	17.7567	18.0939	18.5842	19.1639	19.5926	19.8109	19.8589	19.8549	19.7252	19.1454	18.3384	17.7038	(93)
adjusted MIT	17.7567	18.0939	18.5842	19.1639	19.5926	19.8109	19.8589	19.8549	19.7252	19.1454	18.3384	17.7038	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9907	0.9784	0.9505	0.8850	0.7612	0.5722	0.3902	0.4396	0.7079	0.9210	0.9815	0.9929	(94)
Useful gains	613.9949	764.1521	885.6505	948.3826	879.7324	649.4548	424.5122	445.7851	653.6012	710.8354	621.1228	571.1660	(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	1824.8873	1785.3115	1631.6162	1371.7099	1052.7620	688.8123	430.7886	455.9272	746.1818	1139.8444	1504.9060	1815.6164	(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	900.9040	686.2191	554.9986	304.7956	128.7340	0.0000	0.0000	0.0000	0.0000	319.1827	636.3239	925.8711	(98)
Space heating												4457.0290	(98)
Space heating per m2												51.5025	(99)
(98) / (4) =													

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													4771.9796 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	900.9040	686.2191	554.9986	304.7956	128.7340	0.0000	0.0000	0.0000	0.0000	319.1827	636.3239	925.8711	(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)	964.5653	734.7099	594.2169	326.3337	137.8308	0.0000	0.0000	0.0000	0.0000	341.7373	681.2890	991.2967	(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	88.3281	88.0769	87.5906	86.5256	84.4622	80.3000	80.3000	80.3000	80.3000	86.5226	87.8786	88.4115	(216)
Fuel for water heating, kWh/month	233.8141	206.7345	216.8817	194.7310	193.1397	178.9239	171.4227	191.0962	193.2066	204.1817	213.9873	228.0417	(219)
Water heating fuel used												2426.1611	(219)
Annual totals kWh/year													
Space heating fuel - main system												4771.9796	(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												7639.3000	(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	4771.9796	0.2160	1030.7476 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2426.1611	0.2160	524.0508 (264)
Space and water heating			1554.7984 (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			1783.7601 (272)
Emissions per m2 for space and water heating			17.9662 (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) = (17.9662 * 1.00) + 2.1959 + 0.4498, rounded to 2 d.p.			20.6100 (273)

Appendix C SAP Worksheet Be Green

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	S11818 01			Issued on Date	21/02/2024
Assessment Reference	Be Green ASHP	Prop Type Ref			
Property	Denmark Street, N17 0JL				
SAP Rating	100 A	DER	2.08	TER	30.09
Environmental	100 A	% DER<TER	93.09		
CO ₂ Emissions (t/year)	-0.14	DFEE	43.29	TFEE	67.71
General Requirements Compliance	Pass	% DFEE<TFEE	36.07		
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: Electricity
Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 30.09 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 2.08 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 67.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 43.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.050

3 Air permeability

Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi Electric Ecodan 8.5 kW PUZ-WM85VAA

Secondary heating system: None

5 Cylinder insulation

Hot water storage: Nominal cylinder loss: 1.74 kWh/day
Permitted by DBSCG 2.24 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous supply and extract system
Specific fan power: 0.80
Maximum 1.5 OK
MVHR efficiency: 87%
Minimum: 70% OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 1.08 m², No overhang
Windows facing South: 9.89 m², No overhang
Windows facing West: 7.80 m², No overhang
Air change rate: 5.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.12 W/m²K
Roof U-value 0.12 W/m²K
Floor U-value 0.10 W/m²K
Exposed floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h
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	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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.1500 (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) =		0.1388 (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	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												60.9000 (23c)
Effective ac	0.3724	0.3689	0.3655	0.3481	0.3447	0.3273	0.3273	0.3238	0.3343	0.3447	0.3516	0.3585 (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 = 1.20)			18.7700	1.1450	21.4924		(27)
Roof light (Uw = 1.20)			2.2800	1.1450	2.6107		(27a)
Ground floor			51.1300	0.1000	5.1130		(28a)
Exposed floor			0.4300	0.1000	0.0430		(28b)
External wall	140.5300	18.7700	121.7600	0.1500	18.2640		(29a)
Flat roof	34.9800	2.2800	32.7000	0.1200	3.9240		(30)
Balcony roof	17.0000		17.0000	0.1200	2.0400		(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) =		53.4871		(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 (User defined value 0.050 * total exposed area)							12.2035 (36)
Total fabric heat loss						(33) + (36) =	65.6906 (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	28.9413	28.6717	28.4022	27.0543	26.7847	25.4369	25.4369	25.1673	25.9760	26.7847	27.3239	27.8630 (38)
Heat transfer coeff	94.6319	94.3623	94.0927	92.7449	92.4753	91.1274	91.1274	90.8579	91.6666	92.4753	93.0144	93.5536 (39)
Average = Sum(39)m / 12 =												92.6775 (39)
HLP	1.0935	1.0904	1.0873	1.0717	1.0686	1.0530	1.0530	1.0499	1.0592	1.0686	1.0748	1.0810 (40)
HLP (average)												1.0709 (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	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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:													
Store volume												200.0000 (47)	
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)	
Volume factor from Table 2a												0.8434 (52)	
Temperature factor from Table 2b												0.5400 (53)	
Enter (49) or (54) in (55)												0.9372 (55)	
Total storage loss													
29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (56)		
If cylinder contains dedicated solar storage													
29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (57)		
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	23.2624 (59)		
Total heat required for water heating calculated for each month													
207.8798	183.3103	192.7147	173.0313	169.7644	151.9773	146.2306	160.0845	159.6840	179.4100	189.3615	202.9712 (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 (63)		
Output from w/h	167.7588	148.0095	156.6853	143.3832	142.2334	129.2641	127.0048	136.8075	135.7292	149.8001	155.0666	164.1933 (64)	
Heat gains from water heating, kWh/month	93.5773	83.0411	88.5349	81.2013	80.9040	74.2008	73.0790	77.6854	76.7633	84.1111	86.6311	91.9452 (65)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9891	0.9702	0.9222	0.8071	0.6279	0.4306	0.2897	0.3264	0.5651	0.8672	0.9744	0.9921	(94)
Useful gains	648.7478	792.8040	893.0892	895.0350	749.4548	505.2897	326.3195	343.4293	542.7716	701.0771	651.8091	606.5171	(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	1378.1999	1347.7866	1230.8249	1025.5616	779.3088	508.4621	326.6105	343.9770	555.5352	860.6790	1136.2038	1367.2247	(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	542.7124	372.9483	251.2753	93.9791	22.2113	0.0000	0.0000	0.0000	0.0000	118.7439	348.7642	565.9665	(98)
Space heating												2316.6010	(98)
Space heating per m2											(98) / (4) =	26.7691	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													202.1626	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1145.9096	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	542.7124	372.9483	251.2753	93.9791	22.2113	0.0000	0.0000	0.0000	0.0000	118.7439	348.7642	565.9665	(98)	
Space heating efficiency (main heating system 1)	202.1626	202.1626	202.1626	202.1626	202.1626	0.0000	0.0000	0.0000	0.0000	202.1626	202.1626	202.1626	(210)	
Space heating fuel (main heating system)	268.4534	184.4794	124.2937	46.4869	10.9869	0.0000	0.0000	0.0000	0.0000	58.7368	172.5166	279.9560	(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	167.7588	148.0095	156.6853	143.3832	142.2334	129.2641	127.0048	136.8075	135.7292	149.8001	155.0666	164.1933	(64)	
Efficiency of water heater	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(216)	
(217)m	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	282.8150	(217)	
Fuel for water heating, kWh/month	59.3175	52.3344	55.4020	50.6986	50.2920	45.7062	44.9074	48.3735	47.9922	52.9675	54.8297	58.0568	(219)	
Water heating fuel used												620.8778	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1145.9096	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.0000)														
mechanical ventilation fans (SFP = 1.0000)													287.3076	(230a)
Total electricity for the above, kWh/year													287.3076	(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												347.5671	(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	1145.9096	0.5190	594.7271 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	620.8778	0.5190	322.2356 (264)
Space and water heating			916.9627 (265)
Pumps and fans	287.3076	0.5190	149.1126 (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			180.3873 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			2.0800 (273)

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

DER		2.0800	ZC1
Total Floor Area		86.5400	
Assumed number of occupants		2.5753	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.9249	ZC2
CO2 emissions from cooking, equation (L16)		2.0893	ZC3
Total CO2 emissions		20.0942	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		20.0942	ZC8

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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)			18.7700	1.3258	24.8845		(27)					
TER Room Window (Uw = 1.70)			2.2800	1.5918	3.6292		(27a)					
Ground floor			51.1300	0.1300	6.6469		(28a)					
Exposed floor			0.4300	0.1300	0.0559		(28b)					
External wall	140.5300	18.7700	121.7600	0.1800	21.9168		(29a)					
Flat roof	34.9800	2.2800	32.7000	0.1300	4.2510		(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) =		63.5943		(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) =	89.0573 (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	135.6120	135.3131	135.0202	133.6440	133.3865	132.1879	132.1879	131.9660	132.6496	133.3865	133.9074	134.4519 (39)
Average = Sum(39)m / 12 =												133.6428 (39)
HLP	Jan 1.5670	Feb 1.5636	Mar 1.5602	Apr 1.5443	May 1.5413	Jun 1.5275	Jul 1.5275	Aug 1.5249	Sep 1.5328	Oct 1.5413	Nov 1.5473	Dec 1.5536 (40)
HLP (average)												1.5443 (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	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:												
Store volume												200.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):	1.6525 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8924 (55)
Total storage loss	
27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713	27.6637 (56)
If cylinder contains dedicated solar storage	
27.6637 24.9865 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713 27.6637 26.7713	27.6637 (57)
Primary loss	23.2624 (59)
Total heat required for water heating calculated for each month	
206.4908 182.0557 191.3257 171.6871 168.3754 150.6331 144.8416 158.6955 158.3398 178.0210 188.0173 201.5822	(62)
Solar input	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	
206.4908 182.0557 191.3257 171.6871 168.3754 150.6331 144.8416 158.6955 158.3398 178.0210 188.0173 201.5822	(64)
Heat gains from water heating, kWh/month	2100.0651 (64)
92.4661 82.0375 87.4237 80.1259 79.7928 73.1255 71.9678 76.5742 75.6879 82.9999 85.5557 90.8340	(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 (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)	
124.2824 122.0795 117.5050 111.2860 107.2483 101.5631 96.7309 102.9223 105.1221 111.5590 118.8274 122.0887	(72)
Total internal gains	
442.2123 440.1045 426.0096 403.2055 379.9623 357.5969 343.0795 349.1758 360.8960 383.9179 410.3919 430.3334	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.0800	10.6334	0.6300	0.7000	0.7700	3.5097 (74)
South	9.8900	46.7521	0.6300	0.7000	0.7700	141.3087 (78)
West	7.8000	19.6403	0.6300	0.7000	0.7700	46.8181 (80)
Horizontal	2.2800	26.0000	0.6300	0.7000	1.0000	23.5282 (82)

Solar gains	215.1647	378.5869	543.8972	707.2070	815.1953	817.4902	784.8836	704.3608	601.1415	426.0002	260.0681	182.5341	(83)
Total gains	657.3770	818.6914	969.9067	1110.4125	1195.1576	1175.0871	1127.9631	1053.5366	962.0375	809.9181	670.4600	612.8675	(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 44.3155 44.4134 44.5098 44.9681 45.0549 45.4635 45.4635 45.5399 45.3052 45.0549 44.8797 44.6979													
alpha 3.9544 3.9609 3.9673 3.9979 4.0037 4.0309 4.0309 4.0360 4.0203 4.0037 3.9920 3.9799													
util living area	0.9947	0.9870	0.9679	0.9177	0.8148	0.6536	0.4977	0.5481	0.7804	0.9482	0.9891	0.9959	(86)
MIT 19.3753 19.6169 19.9710 20.3945 20.7298 20.9209 20.9795 20.9699 20.8331 20.3727 19.7875 19.3336													(87)
Th 2 19.6376 19.6401 19.6426 19.6544 19.6566 19.6670 19.6670 19.6689 19.6630 19.6566 19.6522 19.6475													(88)
util rest of house	0.9928	0.9825	0.9566	0.8881	0.7500	0.5430	0.3557	0.4028	0.6834	0.9231	0.9845	0.9945	(89)
MIT 2 17.5290 17.8809 18.3903 18.9855 19.4120 19.6197 19.6607 19.6584 19.5435 18.9736 18.1392 17.4748													(90)
Living area fraction													0.1511 (91)
MIT 17.8081 18.1433 18.6292 19.1984 19.6112 19.8164 19.8600 19.8567 19.7384 19.1850 18.3883 17.7557													(92)
Temperature adjustment													0.0000
adjusted MIT 17.8081 18.1433 18.6292 19.1984 19.6112 19.8164 19.8600 19.8567 19.7384 19.1850 18.3883 17.7557													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9888	0.9751	0.9449	0.8755	0.7475	0.5564	0.3771	0.4245	0.6898	0.9111	0.9779	0.9913	(94)
Ext temp.	650.0067	798.2984	916.4498	972.2082	893.3988	653.8718	425.3817	447.2075	663.6027	737.9441	655.6703	607.5278	(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	1831.8595	1791.9859	1637.6924	1376.3253	1055.2449	689.5434	430.9325	456.1604	747.9305	1145.1270	1511.5906	1822.5930	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	879.2985	667.7580	536.6045	290.9643	120.4135	0.0000	0.0000	0.0000	0.0000	302.9441	616.2626	904.0085	(98)
Space heating per m2												4318.2541	(98)
										(98) / (4) =		49.8989	(99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4618.4536 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	879.2985	667.7580	536.6045	290.9643	120.4135	0.0000	0.0000	0.0000	0.0000	302.9441	616.2626	904.0085	(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)	940.4262	714.1797	573.9086	311.1918	128.7845	0.0000	0.0000	0.0000	0.0000	324.0044	659.1044	966.8540	(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	206.4908	182.0557	191.3257	171.6871	168.3754	150.6331	144.8416	158.6955	158.3398	178.0210	188.0173	201.5822	(64)
Efficiency of water heater (217)m	88.2497	87.9730	87.4191	86.2103	83.9380	79.8000	79.8000	79.8000	79.8000	86.2209	87.7495	88.3403	(216)
Fuel for water heating, kWh/month	233.9848	206.9450	218.8601	199.1491	200.5950	188.7633	181.5058	198.8665	198.4208	206.4707	214.2660	228.1883	(219)
Water heating fuel used												2476.0156	(219)
Annual totals kWh/year													
Space heating fuel - main system												4618.4536	(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												7535.6285	(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	4618.4536	0.2160	997.5860 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2476.0156	0.2160	534.8194 (264)
Space and water heating			1532.4053 (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			1761.3670 (272)
Emissions per m2 for space and water heating			17.7075 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.1959 (272b)
Emissions per m2 for pumps and fans			0.4498 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.7075 * 1.55) + 2.1959 + 0.4498, rounded to 2 d.p.			30.0900 (273)