Energy and Sustainability Statement

33 Gypsy Lane, Great Amwell

9th June 2022

Newark (Head) Office:
Newark Beacon, Beacon Hill Office Park,
Cafferata Way, Newark, Notts, NG24 2TN.
Tel: 01636 653 055

London Office:
344-354 Gray's Inn Road, King's Cross,
London WC1X 8BP.
Tel: 0207 033 3757

Birmingham Office:
2nd Floor Quayside Tower, 252-260 Broad St,
Birmingham B1 2HF.
Tel: 0121 285 2785

info@mesbuildingsolutions.co.uk | www.mesbuildingsolutions.co.uk

MES Building Solutions is part of Midland Energy Services Limited. Registered in England, Company no: 5945430

Document version & history

Issue No.	Date	Comment	Author	Signature
1.0	09/06/22	Draft for comment	T Reynolds	[redacted]

About *MES Building Solutions*

MES Building Solutions is an established consultancy practice specialising in providing building solutions throughout the UK.

We offer a full range of services for both residential and commercial buildings from small individual properties through to highly complex mixed use developments.

We are an industry leader in delivering a professional, accredited and certified service to a wide range of clients including architects, developers, builders, housing associations, the public sector and private householders.

Employing highly qualified staff, our team comes from a variety of backgrounds within the construction industry with combined knowledge of building design, engineering, assessment, construction, development, research and surveying.

We are renowned for our creative thinking and provide a high quality, honest and diligent service.

MES Building Solutions maintains its position at the forefront of changes in planning, building regulations and neighbourly matters, as well as technological advances. Our clients, large or small are therefore assured of a cost effective, cohesive and fully integrated professional service.

List of contents

Section 1: Introduction

1.1 Executive Summary

MES Building Solutions have been engaged to provide an energy statement to address the requirements of East Herts District Council in relation to the proposed development at 33 Gypsy Lane, Great Amwell. The purpose of this energy statement is to provide an overview of how sustainability will be promoted both during and after construction and to establish the predicted energy requirements for the proposed development. It will illustrate how energy efficiency measures in conjunction with renewable generation can be used to reduce the predicted energy consumption and associated carbon dioxide emissions. It will also address the overheating risk of the development and show how domestic potable water use will be minimised.

The applicable planning policies this report will address are policy CC2 of the East Herts District Plan and the additional guidance contained in the East Herts District Council Sustainability SPD (adopted March 2021).

The energy and carbon reductions detailed in this report have been achieved by following the energy hierarchy, which includes:

- Calculation of estimated baseline energy consumption & CO_2 emissions using SAP calculations
- Implementation of the energy hierarchy (be lean, be clean, be green)
- Assessment of the viability of connection to existing heat networks and/or the use of CHP
- Calculation of estimated energy consumption & CO_2 emissions at each stage of energy hierarchy
- Calculation of estimated final energy consumption & CO_2 emissions
- Calculation of reduction in emissions achieved
- Calculation of contribution from renewable, decentralised or low carbon generation, if applicable

In line with the favoured approach of East Herts District Council energy modelling has been undertaken using SAP 2012 to determine the expect energy consumption of the development. SAP10 carbon factors have then been used to calculate the resulting CO_2 emissions from the development.

For the proposed development at 33 Gypsy Lane this has been achieved by the use of;

- Improved building fabric over the Part L 2013 baseline requirements
- Reducing heat loss through uncontrolled ventilation (air leakage)
- The use of an MVHR unit to reduce heat loss through controlled ventilation
- Use of a heat pump to provide space and DHW heating

Table 1a, below, shows the modelled performance based on the SAP calculations for each stage of the Energy Hierarchy. Further details can be found in Section 3 and the appendices to this report.

	Energy Consumption (kWh per annum)	Regulated & unregulated domestic carbon dioxide savings	
		(Tonnes CO_2 per annum)	(%)
Baseline	7,930	1.68	
Be Lean, Be Clean	7,648	1.62	4%
Be Green	4,181	0.97	38%
Cumulative on site savings	4,181	0.97	42%

Table 1a: Total reduction in energy use and carbon emissions –SAP10

An overheating assessment has been undertaken by using the Good Homes Alliance overheating tool. This is an early stage assessment tool that uses a checklist of risk and mitigation factors to provide an indication of a development's likelihood of experiencing overheating. This suggests that the proposed development is at a low risk of overheating. For full details see Section 4 and Appendix C of this report.

Water efficient fittings will be specified for this development to ensure the new apartments achieve the Optional Requirement of the Building Regulations –a mains water consumption of 110 litres per person per day (including 5l/person/day allowance for external use. For the full specification and calculation associated with this please see Section 6 and Appendix G to this report.

1.2 Planning Policy

In terms of planning the main policy contained in the East Herts District Plan is CC2, which is reproduced below;

Policy CC2 Climate Change Mitigation

I. All new developments should demonstrate how carbon dioxide emissions will be minimised across the development site, taking account of all levels of the energy hierarchy. Achieving standards above and beyond the requirements of Building Regulations is encouraged.

II. Carbon reduction should be met on-site unless it can be demonstrated that this is not feasible or viable. In such cases effective offsetting measures to reduce on-site carbon emissions will be accepted as allowable solutions.

III. The energy embodied in construction materials should be reduced through re-use and recycling , where possible, of existing materials and the use of sustainable materials and local sourcing.

Policy WAT4 Efficient Use of Water Resources

Development must minimise the use of mains water by:

(a) Incorporating water saving measures and equipment;

(b) Incorporating the recycling of grey water and utilising natural filtration measures where possible;

(c) Designing residential development so that mains water consumption will meet a target of 110 litres or less per head per day.

East Herts District Council have also issued a Sustainability SPD that includes a series of checklists for key aspects of sustainability.

This report will address the following sections of the above document;

Energy Efficiency & Carbon
Renewable Energy
Water Management

Relevant sections of this report address the aspects of sustainability covered by the checklist, and the completed checklist can be found in Appendix E to this report.

1.4 SAP 10

The following guidance was issued by the GLA, in October 2018, for all new developments;

‘Grid electricity has been significantly decarbonised since the last update of Part L in April 2014 and in July 2018 the Government published updated carbon emission factors (SAP 10) demonstrating this. These new emission factors will however not be incorporated into Part L of the Building Regulations until the Government has consulted on new Building Regulations.

The impact of these new emission factors is significant in that technologies generating on-site electricity (such as gas-engine CHP and solar PV) will not achieve the carbon savings they have to date. It is therefore anticipated that developments will need to utilise alternative or additional technologies to meet the 35 per cent on-site carbon reduction target, including using zero emission or local secondary heat sources.

The GLA has decided that from January 2019 and until central Government updates Part L with the latest carbon emission factors, planning applicants are encouraged to use the SAP 10 emission factors for referable applications when estimating CO_2 emission performance against London Plan policies.

The above is a reflection that the SAP2012 carbon factors are now over 10 years old, and significantly out of date. The use of SAP2012 carbon factors can result in developments targeting specifications that do not achieve the required carbon reductions –for example, significantly less PV generation is required when using SAP2012 carbon factors as when using SAP10 carbon factors.

As a result of the above guidance, and to ensure the accuracy and relevance of the proposed specification, MES have based all calculations within this report on the SAP10 carbon factors –these can be found in Table 2, below.

Emissions kg/CO_2/ kWh		
	Part L 2013	SAP 10
Mains Gas	0.216	0.210
Electricity	0.519	0.233

Table 1b: Part L 2013 and SAP10 emission factors

Section 2: Description of development

2.1 Location

The development site is to located in the village of Great Amwell, which lies between Ware and Hoddesdon. The surrounding area is comprised of a mix of open fields and residential buildings of no more than two storeys in height. The site location can be found in Figure 2.1, below.

Figure 2.1: Aerial Photo

2.2 Details of development

The application is for the construction of a single detached bungalow. Construction is currently proposed as being of masonry construction, with the walls having an insulated cavity, with a timber roof insulated between the joists.

This report is based on the following architectural drawings;

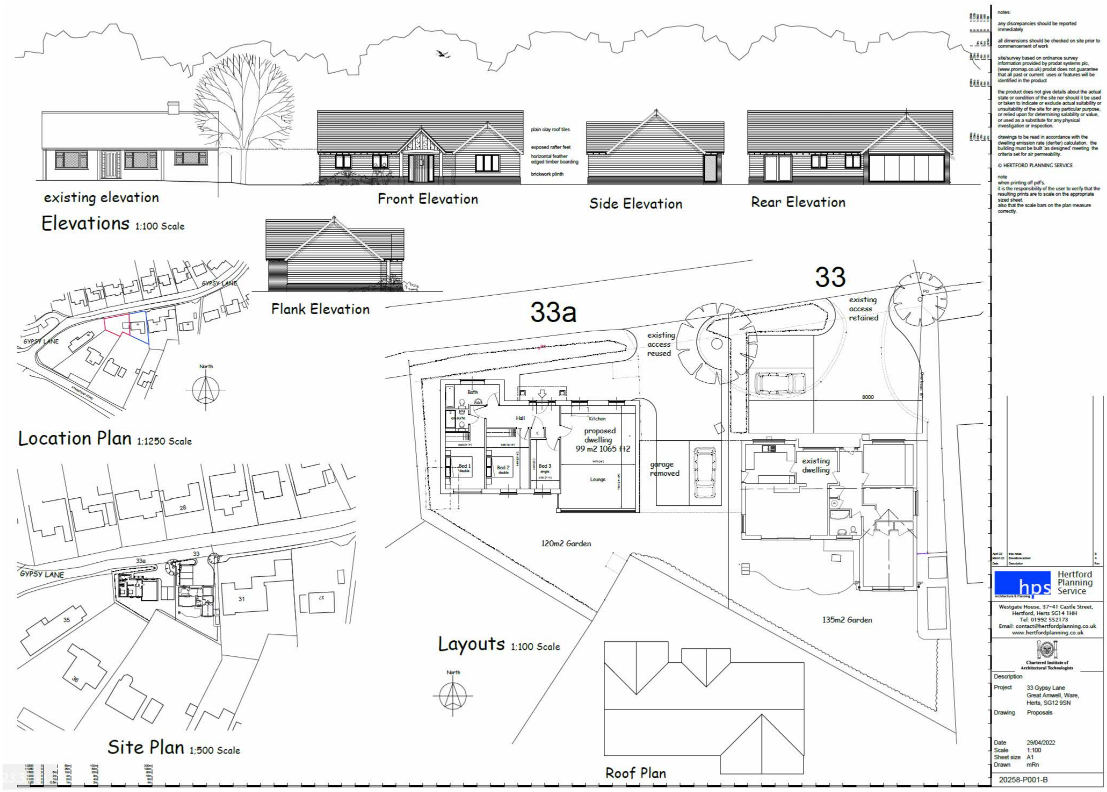


Figure 2.2: Drawing showing the proposed development

Section 3: Energy

3.1 The Energy Hierarchy

In order to address energy efficiency the design team have adopted the energy hierarchy. The energy hierarchy is generally accepted as the most effective way of reducing a buildings' carbon emissions.

1. Be lean: use less energy
2. Be clean: supply energy efficiently
3. Be green: use renewable energy
4. Be seen: monitor, verify and report on energy performance

Development proposals should:

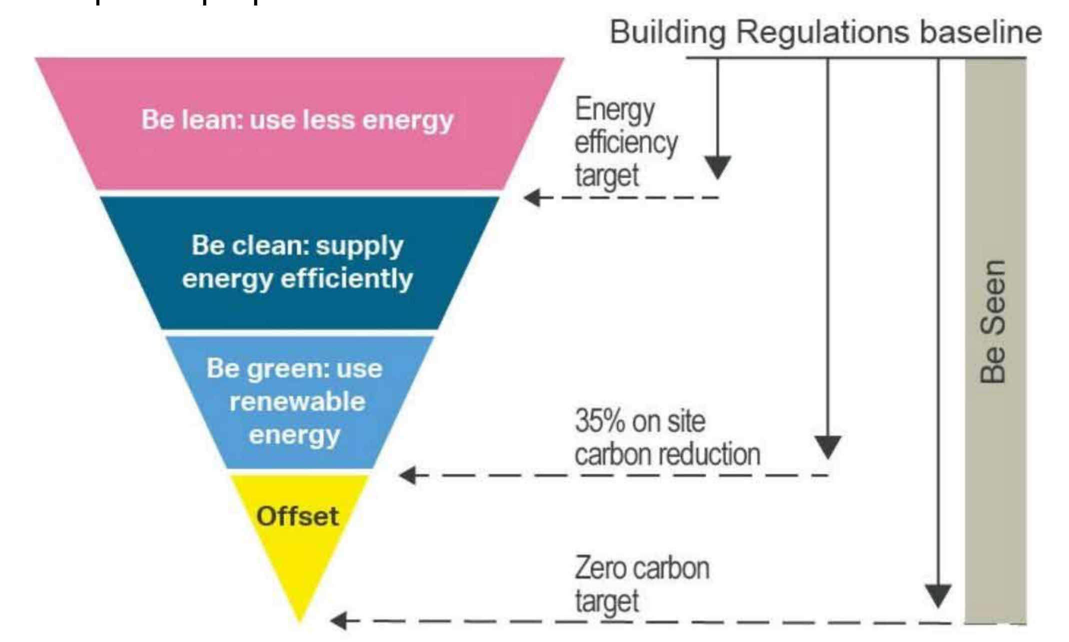


Figure 3a: The Energy Hierarchy

Reducing energy demand

The first step in the process of reducing the overall energy used and CO_2 produced by the building is to minimise the energy required to heat it. A well-insulated building envelope and passive design will reduce the energy requirement for heating and ventilating the building.

Energy efficient systems

The second step is to specify services and controls, lighting and appliances that are energy efficient and which result in further reduction in energy requirements.

Making use of Low or zero-carbon (LZC) technologies

When the energy demand has been reduced by implementing the processes of improving the fabric and energy efficiency, then LZC technologies can be employed to reduce the environmental impact of the remaining energy consumption.

Monitoring and reporting
Ensure comprehensive monitoring and reporting of energy demand and carbon emissions. Major developments in London are required to undertake this process for at least five years.

3.2 Calculating Baseline Energy Demand

The first step is to calculate a Building Regulations Part L 2013 compliant specification in order to establish baseline emissions for the development. For this development energy modelling has been undertaken using SAP 2012. To calculate the associated carbon emissions the energy consumption has been taken from the SAP TER worksheet and SAP10 carbon factors applied. The results are shown in Table 3a below and the SAP worksheet can be found in Appendix A.

	Energy Consumption (kWh per annum)	Regulated & unregulated domestic carbon dioxide savings	
		(Tonnes CO_2 per annum)	(%)
Baseline	7,930	1.68	

Table 3a: Baseline regulated carbon dioxide emissions (SAP10)

It should be noted that as PHPP includes for all energy uses in a building, the above figures include for both regulated and unregulated energy and, therefore, carbon. These figures are, therefore, total operational energy and carbon.

3.3 'Be Lean, Be Clean' – Building Fabric Improvements

The first two steps of the energy hierarchy look at reducing energy consumption in the building through improvements to its fabric and by providing efficient building services. This reduces the energy required to run the building and thus the emissions associated with that energy use.

It can be difficult to achieve further improvements over the fabric & M&E specifications used for the 'Notional Building'. However, some further improvements have been made at this stage by;

- Improved building fabric over the Part L 2013 baseline requirements
- Reducing heat loss through uncontrolled ventilation (air leakage)

The use of an MVHR unit to reduce heat loss through controlled ventilation

The specification of the building elements used in the SAP model for the ‘Be Lean, Be Clean’ stage of the energy hierarchy can be found in Table 3b, below;

Element	‘Be Lean, Be Clean’ Proposed Specification
External Walls	0.18W/m²K
Ground Floor	0.12W/m²K
Roof –insulated in joists	0.10W/m²K
Windows	1.40W/m²K
Doors	1.40W/m²K
Air Permeability	5.00m³/m²/hr
Thermal Bridging	Calculated
Ventilation	System 1
Lighting	Low-E lamps throughout
Space Heating	Mains Gas Boiler
DHW	DHW cylinder heated from main heating system
LZC Technology	none

Table 3b: ‘Be Lean, Be Clean’ specification

The final ‘Be Lean, Be Clean’ CO_2 emission and energy consumption figures, as taken from the SAP model (the SAP worksheet can be found in Appendix A), are shown in Table 3c below:

	Energy Consumption (kWh per annum)	Regulated & unregulated domestic carbon dioxide savings	
		(Tonnes CO_2 per annum)	(%)
Baseline	7,930	1.68	
Be Lean, Be Clean	7,648	1.62	4%

Table 3c: ‘Be Lean, Be Clean’ regulated carbon dioxide emissions (SAP10)

3.4 ‘Be Green’ – CO_2 reduction through the use of renewable or low carbon technology

This section will examine the available renewable energy generation technologies and determine which is most appropriate for the proposed development.

Available Renewable Generation Technologies

Energy resources accepted as renewable or low carbon technologies are defined by the Department of Energy and Climate Change Low Carbon Buildings Program as:

Solar photovoltaics
Wind turbines
Small hydro
Solar thermal hot water
Ground source heat pumps
Air source heat pumps
Bio-energy
Renewable CHP
Micro CHP (Combined heat and power)

Solar Photovoltaics

Solar panel electricity systems, also known as solar photovoltaics (PV), capture the sun's energy using photovoltaic cells. These cells do not need direct sunlight to work – they can still generate some electricity on a cloudy day. The cells convert the sunlight into electricity, which can be used to run household appliances and lighting. When excess power is generated this can be sold back to the grid or stored onsite.

As there is limited roofspace on the proposed development there may not be sufficient space available for this technology to generate enough energy to offset a significant amount of CO_2. As such, this is not considered to be a suitable technology for this development.

Wind Turbines

Wind turbines harness the power of the wind and use it to generate electricity. Forty percent of all the wind energy in Europe blows over the UK, making it an ideal country for domestic turbines. Urban sites such as the location of this development are generally unsuitable for wind turbine installations due to the interrupted turbulent wind flows caused by surrounding buildings and large obstacles. There are also possible issues with noise and 'flicker' for the neighbouring buildings.

The urban nature of the site and lack of space mean that a wind turbine cannot be recommended as a viable option for this development. There are also general issues surrounding the use of building mounted turbines with the potential for excessive noise and vibration within the building and the effect of flicker on surrounding buildings and amenity spaces.

Table 3d: Average wind speeds for the site	
45m above ground level	6.4m/ s
25m above ground level	5.8m/ s
10m above ground level	5.2m/ s

Small Hydro Generation

Hydroelectricity generation uses running water to generate electricity, whether it is a small stream or a larger river. All streams and rivers flow downhill. Before the water flows down the hill, it has potential energy because of its height. Hydro power systems convert this potential energy into kinetic energy in a turbine, which drives a generator to produce electricity. Small, or 'micro' hydro generation requires a reliable source of flowing water with a reasonably constant flow velocity. Systems of this nature are normally installed in locations with a natural moving water source such as a river, stream or spring where part of the flow can be diverted through a generator.

There is no such source of flowing water in this case and small hydro generation is not an option for this development.

Solar Water heating

Solar water heating systems use free heat from the sun to warm domestic hot water. Solar hot water heating can generate a large proportion of a buildings annual DHW requirement. The displaced fuel would be mains gas meaning that the CO_2 savings of this type of system would be relatively low due to the low carbon intensity of the displaced fuel. However, this technology would need sufficient space on the roof for the panels –at least one panel would be required for each apartment. As with photovoltaic panels there is not sufficient space –so this technology is not considered suitable for this development.

Heat Pumps

Heat pumps use similar technology as refrigerators but reversed. A refrigerant liquid is used as a medium to extract heat from a source and convert it into useful heat energy. The heat source used can be generally one of three types; the ground, the air or a body of water. Both ground and water sourced heat pumps use a long circuitous pipe through which a refrigerant is pumped. In ground sourced heat pumps this can be either a coiled pipe or 'slinky' that is buried in a series of horizontal trenches or a loop inside a vertical bore hole to depths that can be up to 200m or deeper. Water sourced heat pumps generally use a similar system to the 'slinky' used for ground sourced systems but either floated on or submerged in a body of water (either a large pool or running water source). Air source heat pumps have a refrigerant coil mounted outside the building through which is passed air so that heat can be extracted. All three types of heat pump generally use the collected heat from the source to heat water. The heated water can then be used for space heating and DHW. Heat pumps require an input of energy to drive pumps, this is usually electricity and so their renewable generation is the difference between the input and output energy. Most have very good efficiencies; energy produced by heat pumps is typically in the region of 2.5 times that which is required to run them, giving efficiencies of 250% and above.

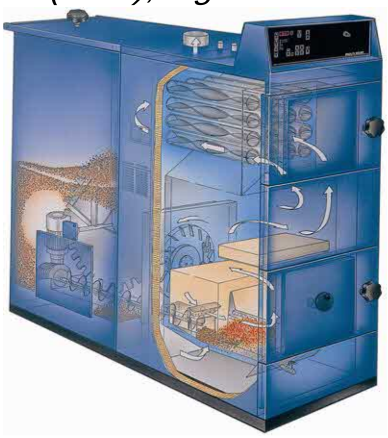
Heat pumps can be considered as a suitable technology for this development. There is limited space available on the site that would facilitate the use of ground loops for a ground source heat pump, as such an air source heat pump would probably be most suitable.

Bio Energy

The Low Carbon Buildings Program (LCBP) defines biomass as follows:

"Biomass is often called 'bioenergy' or 'biofuels'. These biofuels are produced from organic materials, either directly from plants or indirectly from industrial, commercial, domestic or agricultural products. Biofuels fall into two main categories:

> *Woody biomass includes forest products, untreated wood products, energy crops, short rotation coppice (SRC), e.g. willow.*
> *Non-woody biomass includes animal waste, industrial and biodegradable municipal products from food processing and high energy crops, e.g. rape, sugar cane, maize."*



For small-scale domestic [and small scale commercial] applications of biomass the fuel usually takes the form of wood pellets, wood chips and logs. The LCBP goes on to state:

"There are two main ways of using biomass to heat a domestic property:

> *Stand-alone stoves providing space heating for a single room. These can be fuelled by logs or pellets but only pellets are suitable for automatic feed. Generally they are 5-11 kW in output, and some models can be fitted with a back boiler to provide water heating.*
> *Boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW"*

(http://www.lowcarbonbuildings.org.uk/micro/biomass)

This technology is dismissed as the space requirements needed for the boiler and pellet store make this impractical along with complying with the clean air zone requirements.

'Be Green' Modelled Performance

As identified above, heat pumps have been identified as the most suitable technology for this development. For the purposes of this report an ASHP has been modelled –which will generate renewable heat for both space and hot water heating. Should a GSHP be specified it will only reduce the energy consumption, and therefore carbon emissions, further. The combination of this technology and the fabric specification detailed in the 'Be Lean, Be Clean' step results in a final specification for the scheme as shown in Table 3e, below.

Element	'Be Green' Proposed Specification
External Walls	0.18W/m²K
Ground Floor	0.12W/m²K
Roof –insulated in joists	0.10W/m²K
Windows	1.40W/m²K
Doors	1.40W/m²K
Air Permeability	5.00m³/m²/hr
Thermal Bridging	Calculated
Ventilation	System 1
Lighting	Low-E lamps throughout
Space Heating	Air Source Heat Pump
DHW	DHW cylinder heated from main heating system
LZC Technology	none

Table 3e: 'Be Green' specification

The final 'Be Green' CO_2 emission and energy consumption figures, as taken from the SAP model (the SAP worksheet can be found in Appendix B), are shown in Table 3f below:

	Energy Consumption (kWh per annum)	Regulated & unregulated domestic carbon dioxide savings	
		(Tonnes CO_2 per annum)	(%)
Baseline	7,930	1.68	
Be Lean, Be Clean	7,648	1.62	4%
Be Green	4,181	0.97	38%
Cumulative on site savings	4,181	0.97	42%

Table 3f: Total reduction in energy use and carbon emissions –SAP10

Section 4: Overheating

The expected risk of overheating associated with the proposed development has been assessed using the Good Homes Alliance Overheating Risk Tool. The completed tool can be found in Appendix C, but a summary of the key factors likely to increase the likelihood of overheating can be found below;

The site is located in the South East of the England
The site is in a rural, rather than urban, location
The site does not have any specific characteristics that would require windows to be closed or non-openable (aside from ground floor windows, which will be closed at night for security)
The amount of glazing on the east, south and west façades of does not exceed 50% of the total façade area
The proposed dwelling is dual aspect with openable windows on opposing façades

Similarly, the counterbalancing factors that reduce the likelihood of overheating can be found in the completed tool, but a summary of those proposed for the development can be found below.

The site is located in a rural location with the majority of the surroundings being green infrastructure
Windows will be designed to provide large opening areas to help dissipate heat –the opening areas of these will provide a more than 100% increase in the purge rate openable areas as required by Part F (2010).

The result of this is that the GHA tool estimates a low likelihood of overheating.

Section 5: Water Consumption

Water is a precious commodity even in the UK and with ever increasing demand for clean drinking water measures need to be taken to safeguard future supplies.

Approximately 50% of the water consumed in domestic dwellings is not used for consumption, (the percentage is even higher in many commercial buildings) it is for washing and flushing of toilets etc. Measures to reduce the amount of potable water used for these activities reduce the demand for potable water and make better use of this limited resource.

Water use in the development will be reduced to at least 110l/person/day. This reduction in water use will be achieved through specification of water use fittings that do not exceed the following consumption rates;

Taps (other than kitchen taps)		6.00(litres/min)
Kitchen Taps		10.00(litres/min)
Showers		8.00(litres/min)
Baths (with shower over)		170(litres to overflow)
WCs (Flush Volume)	Full Flush:	4.00(litres)
	Part Flush:	2.60(litres)
Washing Machine		8.17(litres/kg dry load)
Dishwasher		1.25(litres/place setting)

For full details of the consumption of this specification please see Appendix D.

In addition to the above the development will be provided with water butts connected to the downpipes at the rear of the property. This will further reduce water consumption by enabling harvested water to be used for plant watering and other garden uses.

Appendix A

'Be Lean, Be Clean' SAP Calculation

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

Property Reference	0005-Herts-Planning-33-Gypsy-L	Issued on Date	09/06/2022
Assessment Reference	Be Lean	Prop Type Ref	
Property	33a, Gypsy Lane, Great Amwell, Ware, Hertfordshire, SG12 9SN		

SAP Rating	84 B	DER	17.66	TER	18.26
Environmental	85 B	% DER<TER	3.28		
CO_2 Emissions (t/year)	1.57	DFEE	49.99	TFEE	59.29
General Requirements Compliance	Pass	% DFEE<TFEE	15.68		

Assessor Details	Mr. Tom Reynolds, MES Building Solutions, Tel: 01636 653055, tom@mesenergyservices.co.uk	Assessor ID	8440-0005
Client			

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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 102 m^2

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) 18.26 kgCO/m^2
Dwelling Carbon Dioxide Emission Rate (DER) 17.66 kgCO/m^2OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.3 kWh/m^2/yr
Dwelling Fabric Energy Efficiency (DFEE)50.0 kWh/m^2/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.046

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from manufacturer
tbc tbc

Efficiency: 89%
Minimum: 88% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 2.01 kWh/day	
Permitted by DBSCG 2.30	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
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:	6.87 m^2, No overhang	
Windows facing South:	18.59 m^2, No overhang	
Windows facing West:	2.18 m^2, No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

10 Key features

Roof U-value	0.10 W/m^2K
Floor U-value	0.12 W/m^2K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

		Area (m2)		Storey height (m)		Volume (m3)
Ground floor		101.8300 (1b)	x	2.4000 (2b)	=	244.3920 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	101.8300					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.3920 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							3 * 10 =	30.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1228 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3728 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3168 (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	0.4040	0.3961	0.3881	0.3485	0.3406	0.3010	0.3010	0.2931	0.3168	0.3406	0.3564	0.3723	(22b)
Effective ac	0.5816	0.5784	0.5753	0.5607	0.5580	0.5453	0.5453	0.5429	0.5502	0.5580	0.5635	0.5693	(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
Door			2.0000	1.4000	2.8000		(26)
Windows (Uw = 1.40)			27.6400	1.3258	36.6439		(27)
Heat Loss Floor			101.8300	0.1200	12.2196	75.0000	7637.2500 (28a)
External Wall	111.5900	29.6400	81.9500	0.1800	14.7510	60.0000	4917.0000 (29a)
External Roof 1	101.8300		101.8300	0.1000	10.1830	9.0000	916.4700 (30)
Total net area of external elements Aum(A, m2)			315.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.5975		(33)
Internal Wall 1			157.3000			9.0000	1415.7000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14886.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		146.1889 (35)
Thermal bridges (User defined value 0.046 * total exposed area)		14.5015 (36)
Total fabric heat loss	(33) + (36) =	91.0990 (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	46.9054	46.6499	46.3994	45.2229	45.0028	43.9781	43.9781	43.7883	44.3728	45.0028	45.4481	45.9136	(38)
Heat transfer coeff	138.0044	137.7489	137.4984	136.3219	136.1018	135.0771	135.0771	134.8874	135.4718	136.1018	136.5471	137.0126	(39)
Average = Sum(39)m / 12 =												136.3209	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3552	1.3527	1.3503	1.3387	1.3366	1.3265	1.3265	1.3246	1.3304	1.3366	1.3409	1.3455	(40)
HLP (average)												1.3387	(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	2.7558 (42)
Average daily hot water use (litres/day)	99.6510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6161	105.6301	101.6441	97.6580	93.6720	89.6859	89.6859	93.6720	97.6580	101.6441	105.6301	109.6161	(44)
Energy conte	162.5576	142.1739	146.7107	127.9060	122.7288	105.9056	98.1371	112.6138	113.9588	132.8079	144.9703	157.4283	(45)
Energy content (annual)										Total = Sum(45)m =		1567.8988	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3836	21.3261	22.0066	19.1859	18.4093	15.8858	14.7206	16.8921	17.0938	19.9212	21.7455	23.6142	(46)

Water storage loss:

Store volume 210.0000 (47)

b) If manufacturer declared loss factor is not known :

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Value	Ref
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0115	(51)
Volume factor from Table 2a	0.8298	(52)
Temperature factor from Table 2b	0.5400	(53)
Enter (49) or (54) in (55)	1.0867	(55)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Total storage loss	33.6864	30.4264	33.6864	32.5997	33.6864	32.5997	33.6864	33.6864	32.5997	33.6864	32.5997	33.6864	(56)
If cylinder contains dedicated solar storage	33.6864	30.4264	33.6864	32.5997	33.6864	32.5997	33.6864	33.6864	32.5997	33.6864	32.5997	33.6864	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.5064	193.6115	203.6595	183.0177	179.6776	161.0174	155.0859	169.5626	169.0705	189.7567	200.0820	214.3771	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Output from w/h	219.5064	193.6115	203.6595	183.0177	179.6776	161.0174	155.0859	169.5626	169.0705	189.7567	200.0820	214.3771	(64)

Total per year (kWh/year) = Sum(64)m = 2238.4249 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Heat gains from water heating, kWh/month	99.6094	88.4229	94.3403	86.6181	86.3664	79.3030	78.1896	83.0031	81.9807	89.7177	92.2920	97.9040	(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	Ref
(66)m	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1126	20.5284	16.6948	12.6390	9.4478	7.9763	8.6186	11.2028	15.0364	19.0922	22.2834	23.7549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.2527	261.9429	255.1636	240.7313	222.5131	205.3906	193.9516	191.2614	198.0407	212.4730	230.6912	247.8138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	(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)	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	(71)
Water heating gains (Table 5)	133.8836	131.5817	126.8015	120.3029	116.0838	110.1431	105.0936	111.5633	113.8621	120.5883	128.1833	131.5913	(72)
Total internal gains	483.5864	481.3905	465.9975	441.0108	415.3823	390.8474	375.0013	381.3651	394.2766	419.4910	448.4954	470.4976	(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	Ref
North	6.8700	10.6334	0.6300	0.7000	0.7700	22.3255	(74)
South	18.5900	46.7521	0.6300	0.7000	0.7700	265.6146	(78)
West	2.1800	19.6403	0.6300	0.7000	0.7700	13.0851	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Solar gains	301.0252	503.2706	668.7767	804.2112	884.8390	873.1249	843.8725	783.4099	715.0418	550.3577	358.7008	258.8876	(83)
Total gains	784.6116	984.6611	1134.7742	1245.2220	1300.2213	1263.9723	1218.8738	1164.7749	1109.3185	969.8487	807.1962	729.3852	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
tau	29.9637	30.0192	30.0739	30.3335	30.3825	30.6130	30.6130	30.6561	30.5238	30.3825	30.2834	30.1805	
alpha	2.9976	3.0013	3.0049	3.0222	3.0255	3.0409	3.0409	3.0437	3.0349	3.0255	3.0189	3.0120	
util living area	0.9736	0.9494	0.9115	0.8453	0.7414	0.5972	0.4579	0.4930	0.6846	0.8717	0.9551	0.9783	(86)
MIT	18.9960	19.3304	19.7507	20.2203	20.6056	20.8563	20.9525	20.9394	20.7704	20.2550	19.5287	18.9292	(87)
Th 2	19.7978	19.7998	19.8017	19.8106	19.8123	19.8201	19.8201	19.8216	19.8171	19.8123	19.8089	19.8054	(88)
util rest of house	0.9681	0.9394	0.8939	0.8137	0.6872	0.5117	0.3467	0.3816	0.6056	0.8384	0.9444	0.9738	(89)
MIT 2	17.1705	17.6507	18.2479	18.9035	19.4092	19.7081	19.7964	19.7888	19.6203	18.9687	17.9484	17.0786	(90)

Living area fraction — fLA = Living area / (4) = 0.4112 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
MIT	17.9211	18.3413	18.8658	19.4450	19.9011	20.1802	20.2717	20.2619	20.0932	19.4976	18.5982	17.8395	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.7711	18.1913	18.7158	19.2950	19.7511	20.0302	20.1217	20.1119	19.9432	19.3476	18.4482	17.6895	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ref
Utilisation	0.9550	0.9216	0.8739	0.7976	0.6841	0.5280	0.3764	0.4105	0.6149	0.8226	0.9279	0.9623	(94)
Useful gains	749.3288	907.4708	991.7340	993.2431	889.4789	667.3198	458.7343	478.0939	682.1234	797.7908	748.9671	701.8901	(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	1859.0751	1830.8667	1679.6517	1417.0611	1095.7756	733.4964	475.7054	500.6895	791.5917	1190.5677	1549.5647	1848.2344	(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	825.6513	620.5220	511.8107	305.1489	153.4847	0.0000	0.0000	0.0000	0.0000	292.2260	576.4302	852.8801	(98)

		Value	Ref
Space heating		4138.1541	(98)
Space heating per m2	(98) / (4) =	40.6379	(99)

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 %)	89.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4649.6114	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	825.6513	620.5220	511.8107	305.1489	153.4847	0.0000	0.0000	0.0000	0.0000	292.2260	576.4302	852.8801	(98)
Space heating efficiency (main heating system 1)	89.0000	89.0000	89.0000	89.0000	89.0000	0.0000	0.0000	0.0000	0.0000	89.0000	89.0000	89.0000	(210)
Space heating fuel (main heating system)	927.6981	697.2158	575.0682	342.8640	172.4548	0.0000	0.0000	0.0000	0.0000	328.3439	647.6744	958.2923	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	219.5064	193.6115	203.6595	183.0177	179.6776	161.0174	155.0859	169.5626	169.0705	189.7567	200.0820	214.3771	(64)
Efficiency of water heater												89.0000	(216)
(217)m	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	89.0000	(217)
Fuel for water heating, kWh/month	246.6364	217.5410	228.8309	205.6379	201.8849	180.9184	174.2539	190.5198	189.9668	213.2098	224.8112	240.8732	(219)
Water heating fuel used												2515.0841	(219)

Annual totals kWh/year		
Space heating fuel - main system	4649.6114	(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)	408.1752	(232)
Total delivered energy for all uses	7647.8707	(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	4649.6114	0.2160	1004.3161	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2515.0841	0.2160	543.2582	(264)
Space and water heating			1547.5742	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.1752	0.5190	211.8429	(268)
Total CO2, kg/year			1798.3421	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.6600	(273)

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

DER		17.6600	ZC1
Total Floor Area	TFA	101.8300	
Assumed number of occupants	N	2.7558	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0867	ZC2
CO2 emissions from cooking, equation (L16)		1.8181	ZC3
Total CO2 emissions		34.5648	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		34.5648	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	101.8300 (1b)	x	2.4000 (2b)	=	244.3920 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 101.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.3920 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							4 * 10 =	40.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1637 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4137 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3516 (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	0.4483	0.4395	0.4307	0.3868	0.3780	0.3340	0.3340	0.3252	0.3516	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5853	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0000	1.0000	2.0000			(26)
TER Opening Type (Uw = 1.40)			23.4600	1.3258	31.1023			(27)
Heat Loss Floor			101.8300	0.1300	13.2379			(28a)
External Wall	111.5900	25.4600	86.1300	0.1800	15.5034			(29a)
External Roof 1	101.8300		101.8300	0.1300	13.2379			(30)
Total net area of external elements Aum(A, m2)			315.2500					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.0815			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7674 (36)
Total fabric heat loss	(33) + (36) =	88.8489 (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	48.4294	48.1147	47.8062	46.3573	46.0862	44.8242	44.8242	44.5905	45.3103	46.0862	46.6346	47.2080	(38)
Heat transfer coeff	137.2783	136.9636	136.6551	135.2062	134.9351	133.6731	133.6731	133.4394	134.1592	134.9351	135.4835	136.0568	(39)
Average = Sum(39)m / 12 =												135.2049	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3481	1.3450	1.3420	1.3278	1.3251	1.3127	1.3127	1.3104	1.3175	1.3251	1.3305	1.3361	(40)
HLP (average)												1.3278	(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	2.7558 (42)
Average daily hot water use (litres/day)	99.6510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6161	105.6301	101.6441	97.6580	93.6720	89.6859	89.6859	93.6720	97.6580	101.6441	105.6301	109.6161	(44)
Energy conte	162.5576	142.1739	146.7107	127.9060	122.7288	105.9056	98.1371	112.6138	113.9588	132.8079	144.9703	157.4283	(45)
Energy content (annual)										Total = Sum(45)m =		1567.8988	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3836	21.3261	22.0066	19.1859	18.4093	15.8858	14.7206	16.8921	17.0938	19.9212	21.7455	23.6142	(46)

Water storage loss:	
Store volume	210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.7016 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.9188 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage													
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(64)
								Total per year (kWh/year) = Sum(64)m =				2177.1731	(64)
Heat gains from water heating, kWh/month													
	95.4477	84.6639	90.1786	82.5906	82.2046	75.2755	74.0279	78.8414	77.9532	85.5559	88.2645	93.7422	(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	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	23.1126	20.5284	16.6948	12.6390	9.4478	7.9763	8.6186	11.2028	15.0364	19.0922	22.2834	23.7549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	259.2527	261.9429	255.1636	240.7313	222.5131	205.3906	193.9516	191.2614	198.0407	212.4730	230.6912	247.8138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	(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)													
	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	(71)
Water heating gains (Table 5)													
	128.2899	125.9879	121.2078	114.7092	110.4901	104.5493	99.4998	105.9696	108.2683	114.9945	122.5896	125.9976	(72)
Total internal gains													
	477.9926	475.7968	460.4037	435.4170	409.7885	385.2536	369.4076	375.7713	388.6829	413.8972	442.9017	464.9038	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	5.8300	10.6334	0.6300	0.7000	0.7700	18.9458 (74)
South	15.7800	46.7521	0.6300	0.7000	0.7700	225.4653 (78)
West	1.8500	19.6403	0.6300	0.7000	0.7700	11.1043 (80)

Solar gains	255.5153	427.1827	567.6611	682.6096	751.0378	741.0914	716.2640	664.9504	606.9281	467.1494	304.4710	219.7485	(83)
Total gains	733.5080	902.9794	1028.0648	1118.0266	1160.8262	1126.3451	1085.6716	1040.7217	995.6110	881.0466	747.3727	684.6523	(84)

---

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.5123	51.6307	51.7473	52.3018	52.4069	52.9017	52.9017	52.9943	52.7100	52.4069	52.1948	51.9748	
alpha	4.4342	4.4420	4.4498	4.4868	4.4938	4.5268	4.5268	4.5330	4.5140	4.4938	4.4797	4.4650	
util living area													
	0.9956	0.9887	0.9733	0.9345	0.8483	0.6922	0.5257	0.5664	0.7876	0.9502	0.9903	0.9968	(86)
MIT	19.6094	19.8312	20.1259	20.4719	20.7586	20.9321	20.9844	20.9782	20.8733	20.4940	19.9793	19.5698	(87)
Th 2	19.8033	19.8057	19.8081	19.8191	19.8212	19.8309	19.8309	19.8327	19.8272	19.8212	19.8170	19.8127	(88)
util rest of house													
	0.9942	0.9849	0.9640	0.9109	0.7937	0.5915	0.3941	0.4341	0.6998	0.9272	0.9864	0.9957	(89)
MIT 2	17.9793	18.3028	18.7280	19.2200	19.5927	19.7876	19.8256	19.8244	19.7333	19.2618	18.5279	17.9280	(90)
Living area fraction									fLA = Living area / (4) =			0.4112	(91)
MIT	18.6495	18.9312	19.3028	19.7347	20.0721	20.2582	20.3021	20.2988	20.2021	19.7684	19.1247	18.6030	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6495	18.9312	19.3028	19.7347	20.0721	20.2582	20.3021	20.2988	20.2021	19.7684	19.1247	18.6030	(93)

---

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9921	0.9812	0.9590	0.9089	0.8067	0.6306	0.4486	0.4889	0.7307	0.9259	0.9833	0.9940	(94)
Useful gains	727.7172	885.9911	985.9478	1016.1469	936.4192	710.2904	487.0816	508.7832	727.5247	815.7682	734.8691	680.5690	(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													
	1969.8806	1921.7655	1749.5691	1464.9202	1129.6893	756.3471	494.8682	520.2597	818.6463	1237.1414	1629.1456	1959.6315	(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													
	924.1696	696.0404	568.1343	323.1168	143.7929	0.0000	0.0000	0.0000	0.0000	313.5017	643.8791	951.6225	(98)
Space heating												4564.2571	(98)
Space heating per m2											(98) / (4) =	44.8223	(99)

8c. Space cooling requirement

Not applicable

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design System) version 4.14r10

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4881.5584	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	924.1696	696.0404	568.1343	323.1168	143.7929	0.0000	0.0000	0.0000	0.0000	313.5017	643.8791	951.6225	(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)	988.4166	744.4283	607.6302	345.5794	153.7892	0.0000	0.0000	0.0000	0.0000	335.2959	688.6407	1017.7781	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.2720	87.9817	87.4639	86.3859	84.3032	79.8000	79.8000	79.8000	79.8000	86.2163	87.7640	88.3649	(217)
Fuel for water heating, kWh/month	242.7770	214.7183	226.9019	206.0329	206.9617	195.4674	187.8242	205.9654	205.5590	214.0599	222.2410	236.7171	(219)

Water heating fuel used	2565.2258	(219)
Annual totals kWh/year		
Space heating fuel - main system	4881.5584	(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)	408.1752	(232)
Total delivered energy for all uses	7929.9594	(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	4881.5584	0.2160	1054.4166	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.2258	0.2160	554.0888	(264)
Space and water heating			1608.5054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.1752	0.5190	211.8429	(268)
Total CO2, kg/m2/year			1859.2733	(272)
Emissions per m2 for space and water heating			15.7960	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.0804	(272b)
Emissions per m2 for pumps and fans			0.3823	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7960 * 1.00) + 2.0804 + 0.3823, rounded to 2 d.p.			18.2600	(273)

Appendix B

‘Be Green’ SAP Calculation

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

Property Reference	0005-Herts-Planning-33-Gypsy-L	Issued on Date	09/06/2022
Assessment Reference	Be Green	Prop Type Ref	
Property	33a, Gypsy Lane, Great Amwell, Ware, Hertfordshire, SG12 9SN		

SAP Rating	80 C	DER	21.08	TER	26.95
Environmental	82 B	% DER<TER	21.77		
CO_2 Emissions (t/year)	1.86	DFEE	49.99	TFEE	59.29
General Requirements Compliance	Pass	% DFEE<TFEE	15.68		

Assessor Details	Mr. Tom Reynolds, MES Building Solutions, Tel: 01636 653055, tom@mesenergyservices.co.uk	Assessor ID	8440-0005
Client			

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

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

DWELLING AS DESIGNED

Detached Bungalow, total floor area 102 m^2

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) 26.95 kgCO/m^2
Dwelling Carbon Dioxide Emission Rate (DER) 21.08 kgCO/m^2OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)59.3 kWh/m^2/yr
Dwelling Fabric Energy Efficiency (DFEE)50.0 kWh/m^2/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated using user-specified y-value of 0.046

3 Air permeability

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

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric
Air-to-water heat pump	
Secondary heating system:	None

5 Cylinder insulation

Hot water storage	Nominal cylinder loss: 2.01 kWh/day	
Permitted by DBSCG 2.30	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

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

Minimum	75%	OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Slight	OK
Based on:		
Overshading:	Average	
Windows facing North:	6.87 m^2, No overhang	
Windows facing South:	18.59 m^2, No overhang	
Windows facing West:	2.18 m^2, No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	None	

10 Key features

Roof U-value	0.10 W/m^2K
Floor U-value	0.12 W/m^2K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	101.8300 (1b)	x	2.4000 (2b)	=	244.3920 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 101.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.3920 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							3 * 10 =	30.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1228 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.3728 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3168 (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	0.4040	0.3961	0.3881	0.3485	0.3406	0.3010	0.3010	0.2931	0.3168	0.3406	0.3564	0.3723	(22b)
Effective ac	0.5816	0.5784	0.5753	0.5607	0.5580	0.5453	0.5453	0.5429	0.5502	0.5580	0.5635	0.5693	(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
Door			2.0000	1.4000	2.8000		(26)
Windows (Uw = 1.40)			27.6400	1.3258	36.6439		(27)
Heat Loss Floor			101.8300	0.1200	12.2196	75.0000	7637.2500 (28a)
External Wall	111.5900	29.6400	81.9500	0.1800	14.7510	60.0000	4917.0000 (29a)
External Roof 1	101.8300		101.8300	0.1000	10.1830	9.0000	916.4700 (30)
Total net area of external elements Aum(A, m2)			315.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	76.5975		(33)
Internal Wall 1			157.3000			9.0000	1415.7000 (32c)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	14886.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		146.1889 (35)
Thermal bridges (User defined value 0.046 * total exposed area)		14.5015 (36)
Total fabric heat loss	(33) + (36) =	91.0990 (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	46.9054	46.6499	46.3994	45.2229	45.0028	43.9781	43.9781	43.7883	44.3728	45.0028	45.4481	45.9136	(38)
Heat transfer coeff	138.0044	137.7489	137.4984	136.3219	136.1018	135.0771	135.0771	134.8874	135.4718	136.1018	136.5471	137.0126	(39)
Average = Sum(39)m / 12 =												136.3209	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3552	1.3527	1.3503	1.3387	1.3366	1.3265	1.3265	1.3246	1.3304	1.3366	1.3409	1.3455	(40)
HLP (average)												1.3387	(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	2.7558 (42)
Average daily hot water use (litres/day)	99.6510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6161	105.6301	101.6441	97.6580	93.6720	89.6859	89.6859	93.6720	97.6580	101.6441	105.6301	109.6161	(44)
Energy conte	162.5576	142.1739	146.7107	127.9060	122.7288	105.9056	98.1371	112.6138	113.9588	132.8079	144.9703	157.4283	(45)
Energy content (annual)										Total = Sum(45)m =		1567.8988	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3836	21.3261	22.0066	19.1859	18.4093	15.8858	14.7206	16.8921	17.0938	19.9212	21.7455	23.6142	(46)

Water storage loss:

Store volume	210.0000 (47)

b) If manufacturer declared loss factor is not known :

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

```
  Hot water storage loss factor from Table 2 (kWh/litre/day)                                                                          0.0115 (51)
  Volume factor from Table 2a                                                                                                         0.8298 (52)
  Temperature factor from Table 2b                                                                                                    0.5400 (53)
Enter (49) or (54) in (55)                                                                                                            1.0867 (55)
Total storage loss
                33.6864    30.4264    33.6864    32.5997    33.6864    32.5997    33.6864    33.6864    32.5997    33.6864    32.5997    33.6864 (56)
If cylinder contains dedicated solar storage
                33.6864    30.4264    33.6864    32.5997    33.6864    32.5997    33.6864    33.6864    32.5997    33.6864    32.5997    33.6864 (57)
Primary loss    23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
               219.5064   193.6115   203.6595   183.0177   179.6776   161.0174   155.0859   169.5626   169.0705   189.7567   200.0820   214.3771 (62)
Solar input      0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                          Solar input (sum of months) = Sum(63)m =    0.0000 (63)
Output from w/h
               219.5064   193.6115   203.6595   183.0177   179.6776   161.0174   155.0859   169.5626   169.0705   189.7567   200.0820   214.3771 (64)
                                                                                            Total per year (kWh/year) = Sum(64)m = 2238.4249 (64)
Heat gains from water heating, kWh/month
                99.6094    88.4229    94.3403    86.6181    86.3664    79.3030    78.1896    83.0031    81.9807    89.7177    92.2920    97.9040 (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          137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916   137.7916 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                23.1126    20.5284    16.6948    12.6390     9.4478     7.9763     8.6186    11.2028    15.0364    19.0922    22.2834    23.7549 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               259.2527   261.9429   255.1636   240.7313   222.5131   205.3906   193.9516   191.2614   198.0407   212.4730   230.6912   247.8138 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792    36.7792 (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)
              -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333  -110.2333 (71)
Water heating gains (Table 5)
               133.8836   131.5817   126.8015   120.3029   116.0838   110.1431   105.0936   111.5633   113.8621   120.5883   128.1833   131.5913 (72)
Total internal gains
               483.5864   481.3905   465.9975   441.0108   415.3823   390.8474   375.0013   381.3651   394.2766   419.4910   448.4954   470.4976 (73)


----------------------------------------------------------------------------------------------------
6. Solar gains
----------------------------------------------------------------------------------------------------
[Jan]                                       Area         Solar flux               g                 FF              Access               Gains
                                              m2          Table 6a    Specific data     Specific data              factor                   W
                                                              W/m2      or Table 6b       or Table 6c            Table 6d
----------------------------------------------------------------------------------------------------
North                                     6.8700           10.6334           0.6300            0.7000              0.7700             22.3255 (74)
South                                    18.5900           46.7521           0.6300            0.7000              0.7700            265.6146 (78)
West                                      2.1800           19.6403           0.6300            0.7000              0.7700             13.0851 (80)
----------------------------------------------------------------------------------------------------

Solar gains    301.0252   503.2706   668.7767   804.2112   884.8390   873.1249   843.8725   783.4099   715.0418   550.3577   358.7008   258.8876 (83)
Total gains    784.6116   984.6611  1134.7742  1245.2220  1300.2213  1263.9723  1218.8738  1164.7749  1109.3185   969.8487   807.1962   729.3852 (84)


----------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
----------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                          21.0000 (85)
Utilisation factor for gains for living area, ni1,m (see Table 9a)
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             29.9637    30.0192    30.0739    30.3335    30.3825    30.6130    30.6130    30.6561    30.5238    30.3825    30.2834    30.1805
alpha            2.9976     3.0013     3.0049     3.0222     3.0255     3.0409     3.0409     3.0437     3.0349     3.0255     3.0189     3.0120
util living area
                 0.9736     0.9494     0.9115     0.8453     0.7414     0.5972     0.4579     0.4930     0.6846     0.8717     0.9551     0.9783 (86)

MIT             18.9960    19.3304    19.7507    20.2203    20.6056    20.8563    20.9525    20.9394    20.7704    20.2550    19.5287    18.9292 (87)
Th 2            19.7978    19.7998    19.8017    19.8106    19.8123    19.8201    19.8201    19.8216    19.8171    19.8123    19.8089    19.8054 (88)
util rest of house
                 0.9681     0.9394     0.8939     0.8137     0.6872     0.5117     0.3467     0.3816     0.6056     0.8384     0.9444     0.9738 (89)
MIT 2           17.1705    17.6507    18.2479    18.9035    19.4092    19.7081    19.7964    19.7888    19.6203    18.9687    17.9484    17.0786 (90)
Living area fraction                                                                                 fLA = Living area / (4) =       0.4112 (91)
MIT             17.9211    18.3413    18.8658    19.4450    19.9011    20.1802    20.2717    20.2619    20.0932    19.4976    18.5982    17.8395 (92)
Temperature adjustment                                                                                                               0.0000
adjusted MIT    17.9211    18.3413    18.8658    19.4450    19.9011    20.1802    20.2717    20.2619    20.0932    19.4976    18.5982    17.8395 (93)


----------------------------------------------------------------------------------------------------
8. Space heating requirement
----------------------------------------------------------------------------------------------------

                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Utilisation      0.9562     0.9235     0.8770     0.8025     0.6916     0.5393     0.3908     0.4250     0.6256     0.8279     0.9300     0.9633 (94)
Useful gains   750.2551   909.3599   995.1498   999.2454   899.2865   681.6533   476.3456   495.0564   694.0379   802.9195   750.6644   702.6287 (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
              1879.7758  1851.5290  1700.2765  1437.5094  1116.1909   753.7580   495.9670   520.9226   811.9125  1210.9830  1570.0467  1868.7863 (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
               840.3634   633.1377   524.6142   315.5500   161.3769     0.0000     0.0000     0.0000     0.0000   303.5993   589.9553   867.6212 (98)
Space heating                                                                                                                     4236.2180 (98)
Space heating per m2                                                                                            (98) / (4) =      41.6009 (99)


----------------------------------------------------------------------------------------------------
```

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 %)	175.1000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2419.3135	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	840.3634	633.1377	524.6142	315.5500	161.3769	0.0000	0.0000	0.0000	0.0000	303.5993	589.9553	867.6212	(98)
Space heating efficiency (main heating system 1)	175.1000	175.1000	175.1000	175.1000	175.1000	0.0000	0.0000	0.0000	0.0000	175.1000	175.1000	175.1000	(210)
Space heating fuel (main heating system)	479.9334	361.5863	299.6084	180.2113	92.1627	0.0000	0.0000	0.0000	0.0000	173.3862	336.9248	495.5004	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	219.5064	193.6115	203.6595	183.0177	179.6776	161.0174	155.0859	169.5626	169.0705	189.7567	200.0820	214.3771	(64)
Efficiency of water heater												175.1000	(216)
(217)m	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	175.1000	(217)
Fuel for water heating, kWh/month	125.3606	110.5720	116.3104	104.5218	102.6143	91.9574	88.5699	96.8376	96.5565	108.3705	114.2673	122.4312	(219)
Water heating fuel used												1278.3694	(219)

Annual totals kWh/year		
Space heating fuel - main system	2419.3135	(211)
Space heating fuel - secondary	0.0000	(215)
Electricity for pumps and fans:		
central heating pump	30.0000	(230c)
Total electricity for the above, kWh/year	30.0000	(231)
Electricity for lighting (calculated in Appendix L)	408.1752	(232)
Total delivered energy for all uses	4135.8581	(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	2419.3135	0.5190	1255.6237	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1278.3694	0.5190	663.4737	(264)
Space and water heating			1919.0975	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	408.1752	0.5190	211.8429	(268)
Total CO2, kg/year			2146.5104	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			21.0800	(273)

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

DER		21.0800	ZC1
Total Floor Area	TFA	101.8300	
Assumed number of occupants	N	2.7558	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0867	ZC2
CO2 emissions from cooking, equation (L16)		1.8181	ZC3
Total CO2 emissions		37.9848	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		37.9848	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)
Ground floor	101.8300 (1b)	x	2.4000 (2b)	=	244.3920 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n) 101.8300					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	244.3920 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans							4 * 10 =	40.0000 (7a)
Number of passive vents							0 * 10 =	0.0000 (7b)
Number of flueless gas fires							0 * 40 =	0.0000 (7c)

		Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1637 (8)
Pressure test		Yes
Measured/design AP50		5.0000
Infiltration rate		0.4137 (18)
Number of sides sheltered		2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3516 (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	0.4483	0.4395	0.4307	0.3868	0.3780	0.3340	0.3340	0.3252	0.3516	0.3780	0.3956	0.4132	(22b)
Effective ac	0.6005	0.5966	0.5928	0.5748	0.5714	0.5558	0.5558	0.5529	0.5618	0.5714	0.5782	0.5853	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			2.0000	1.0000	2.0000		(26)
TER Opening Type (Uw = 1.40)			23.4600	1.3258	31.1023		(27)
Heat Loss Floor			101.8300	0.1300	13.2379		(28a)
External Wall	111.5900	25.4600	86.1300	0.1800	15.5034		(29a)
External Roof 1	101.8300		101.8300	0.1300	13.2379		(30)
Total net area of external elements Aum(A, m2)			315.2500				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.0815		(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		13.7674 (36)
Total fabric heat loss	(33) + (36) =	88.8489 (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	48.4294	48.1147	47.8062	46.3573	46.0862	44.8242	44.8242	44.5905	45.3103	46.0862	46.6346	47.2080	(38)
Heat transfer coeff	137.2783	136.9636	136.6551	135.2062	134.9351	133.6731	133.6731	133.4394	134.1592	134.9351	135.4835	136.0568	(39)
Average = Sum(39)m / 12 =												135.2049	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3481	1.3450	1.3420	1.3278	1.3251	1.3127	1.3127	1.3104	1.3175	1.3251	1.3305	1.3361	(40)
HLP (average)												1.3278	(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	2.7558 (42)
Average daily hot water use (litres/day)	99.6510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	109.6161	105.6301	101.6441	97.6580	93.6720	89.6859	89.6859	93.6720	97.6580	101.6441	105.6301	109.6161	(44)
Energy conte	162.5576	142.1739	146.7107	127.9060	122.7288	105.9056	98.1371	112.6138	113.9588	132.8079	144.9703	157.4283	(45)
Energy content (annual)										Total = Sum(45)m =		1567.8988	(45)
Distribution loss (46)m = 0.15 x (45)m	24.3836	21.3261	22.0066	19.1859	18.4093	15.8858	14.7206	16.8921	17.0938	19.9212	21.7455	23.6142	(46)

Water storage loss:	
Store volume	210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.7016 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.9188 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(64)
Total per year (kWh/year) = Sum(64)m =												2177.1731	(64)
Heat gains from water heating, kWh/month	95.4477	84.6639	90.1786	82.5906	82.2046	75.2755	74.0279	78.8414	77.9532	85.5559	88.2645	93.7422	(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	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	137.7916	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1126	20.5284	16.6948	12.6390	9.4478	7.9763	8.6186	11.2028	15.0364	19.0922	22.2834	23.7549	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.2527	261.9429	255.1636	240.7313	222.5131	205.3906	193.9516	191.2614	198.0407	212.4730	230.6912	247.8138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	36.7792	(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)	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	-110.2333	(71)
Water heating gains (Table 5)	128.2899	125.9879	121.2078	114.7092	110.4901	104.5493	99.4998	105.9696	108.2683	114.9945	122.5896	125.9976	(72)
Total internal gains	477.9926	475.7968	460.4037	435.4170	409.7885	385.2536	369.4076	375.7713	388.6829	413.8972	442.9017	464.9038	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	5.8300	10.6334	0.6300	0.7000	0.7700	18.9458	(74)
South	15.7800	46.7521	0.6300	0.7000	0.7700	225.4653	(78)
West	1.8500	19.6403	0.6300	0.7000	0.7700	11.1043	(80)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	255.5153	427.1827	567.6611	682.6096	751.0378	741.0914	716.2640	664.9504	606.9281	467.1494	304.4710	219.7485	(83)
Total gains	733.5080	902.9794	1028.0648	1118.0266	1160.8262	1126.3451	1085.6716	1040.7217	995.6110	881.0466	747.3727	684.6523	(84)

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, ni1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.5123	51.6307	51.7473	52.3018	52.4069	52.9017	52.9017	52.9943	52.7100	52.4069	52.1948	51.9748	
alpha	4.4342	4.4420	4.4498	4.4868	4.4938	4.5268	4.5268	4.5330	4.5140	4.4938	4.4797	4.4650	
util living area	0.9956	0.9887	0.9733	0.9345	0.8483	0.6922	0.5257	0.5664	0.7876	0.9502	0.9903	0.9968	(86)
MIT	19.6094	19.8312	20.1259	20.4719	20.7586	20.9321	20.9844	20.9782	20.8733	20.4940	19.9793	19.5698	(87)
Th 2	19.8033	19.8057	19.8081	19.8191	19.8212	19.8309	19.8309	19.8327	19.8272	19.8212	19.8170	19.8127	(88)
util rest of house	0.9942	0.9849	0.9640	0.9109	0.7937	0.5915	0.3941	0.4341	0.6998	0.9272	0.9864	0.9957	(89)
MIT 2	17.9793	18.3028	18.7280	19.2200	19.5927	19.7876	19.8256	19.8244	19.7333	19.2618	18.5279	17.9280	(90)
Living area fraction									fLA = Living area / (4) =			0.4112	(91)
MIT	18.6495	18.9312	19.3028	19.7347	20.0721	20.2582	20.3021	20.2988	20.2021	19.7684	19.1247	18.6030	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6495	18.9312	19.3028	19.7347	20.0721	20.2582	20.3021	20.2988	20.2021	19.7684	19.1247	18.6030	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9921	0.9812	0.9590	0.9089	0.8067	0.6306	0.4486	0.4889	0.7307	0.9259	0.9833	0.9940	(94)
Useful gains	727.7172	885.9911	985.9478	1016.1469	936.4192	710.2904	487.0816	508.7832	727.5247	815.7682	734.8691	680.5690	(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	1969.8806	1921.7655	1749.5691	1464.9202	1129.6893	756.3471	494.8682	520.2597	818.6463	1237.1414	1629.1456	1959.6315	(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	924.1696	696.0404	568.1343	323.1168	143.7929	0.0000	0.0000	0.0000	0.0000	313.5017	643.8791	951.6225	(98)
Space heating												4564.2571	(98)
Space heating per m2											(98) / (4) =	44.8223	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4881.5584	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	924.1696	696.0404	568.1343	323.1168	143.7929	0.0000	0.0000	0.0000	0.0000	313.5017	643.8791	951.6225	(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)	988.4166	744.4283	607.6302	345.5794	153.7892	0.0000	0.0000	0.0000	0.0000	335.2959	688.6407	1017.7781	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Water heating requirement	214.3042	188.9127	198.4573	177.9833	174.4754	155.9830	149.8837	164.3604	164.0361	184.5545	195.0476	209.1749	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.2720	87.9817	87.4639	86.3859	84.3032	79.8000	79.8000	79.8000	79.8000	86.2163	87.7640	88.3649	(217)
Fuel for water heating, kWh/month	242.7770	214.7183	226.9019	206.0329	206.9617	195.4674	187.8242	205.9654	205.5590	214.0599	222.2410	236.7171	(219)

Water heating fuel used	2565.2258	(219)
Annual totals kWh/year		
Space heating fuel - main system	4881.5584	(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)	408.1752	(232)
Total delivered energy for all uses	7929.9594	(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	4881.5584	0.2160	1054.4166	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2565.2258	0.2160	554.0888	(264)
Space and water heating			1608.5054	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	408.1752	0.5190	211.8429	(268)
Total CO2, kg/m2/year			1859.2733	(272)
Emissions per m2 for space and water heating			15.7960	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.0804	(272b)
Emissions per m2 for pumps and fans			0.3823	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7960 * 1.55) + 2.0804 + 0.3823, rounded to 2 d.p.			26.9500	(273)

Appendix C

GHA Overheating Tool

EARLY STAGE OVERHEATING RISK TOOL

: I WWMSR /Y P]

8 L MWSS P TVS ZM H IW K Y MHE RGI S R L S[X SE WW WWSZI V LI EXMRK VM WO MRV I WWH RXME PWG L Q I WEXX LII EVP] WX EKWSJ H IW MKR. XMWWT I GM´GEP P]

a pre-detail design assessment intended to help identify factors that could contribute to or mitigate the likelihood of overheating.

8LI UYI WXMSR WGERFI ERW[I VI HGSVERGZIVEPMGLIQSVSVMR HZMHYEPHMXKXGSVI ^IVS[LIVI Z XLI UYI WXMSR HSI WRSXEETPP]

Additional information is provided in the accompanying guidance, with examples of scoring and advice on next steps.

Find out more information and download accompanying guidance at KSSHLSQ IWSYKYGSZIVLIEXMRKMRRI[LSQIW.

Good Homes Alliance

KEY FACTORS INCREASING THE LIKELIHOOD OF OVERHEATING	KEY FACTORS REDUCING THE LIKELIHOOD OF OVERHEATING

Geographical and local context

: K H U H L V W K H VFKHP HLQWKH8. " 6 HHJX LGDQFH IRUPDS	6 R X WK HD V W	4	4
	1 R UWK H UQ (Q J O DQG 6 FRW O DQG 1 ,	0	
	5 H V WRI (Q J O DQG DQG : ales	2	
, V WKH VLWH OLNHO\ WR VHHDQ8 UE DQ+ HDW ,V ODQG HI I HF W" 6 HHJX LGDQFH IRU GHWDLO V	&HQWUDO/RQGRQ VHH JXLGDQFH	3	0
	* UHDWHU/RQGRQ DQGOD FKHVWHU %KDP	2	
	2 WKHUFLWLHVWRZQV GHQVHVXE XUEDQDUHDV	1	

' R WK H VLWH VXUURXQGLQJ V I H DWXUHV LQ I ÀFDQW EOXH JUHHQLQIUDVWUXFWXUH" 3 UR[LP LW\ WR UHHQVSDFHDQGODUJHZDWHERG LHVEHQHÀFLDOH IIHFWVRQORFDOWHPSHUD WXUHVDVLGLQFHQWHLV Z RXOG UHT XLUHD VLJQLÀFDQW SURSRUWLRQ RIVXUURXQGLQJ VZLWKLQ DP UDGLXVWREHEOXHJUHHQRUDUXUDOFRQWH[W	1	1

Site characteristics

' RHV WKH VLWH KDYH E DUULHUV WR ZLQGRZ RSHQLQJ " 1 RLVH $FRXVWLFULVNV 3 RRUDLU TXDOLW\VPHOOV H J QHDUDLUSRUWPDLQUG RUDLUSRUW YHU\ EXV\ URDG 6 HFXULW\ULVNVFULPH $ GMDFHQWWRKHDWUHMHFWLRQ SODQW	Day UHDVRQV WRNHHSDOO ZLQGRZV FORVHG	8	0
	Day EDUULHUVRPHRIWKH WLPH HRU RVRPHZLQGRZ VHJ RQ RQH IDFDGH	4	
	Night UHDVRQV WRNHHSDOO ZLQGRZV FORVHG	8	4
	Night EHGURRPZLQGRZV2. WR RSHQ EXWRWKHUZLQGRZV DUH OLNHO\WRVWD\FORVHG	4	

$ UH LP PHGL DWH VXUURXQGLQJ V XU IDFHV LQ PDMR ULW\ SDOH LQ FRO RXU RUOLJKWHU EXLOGLQJ PDWHULDOV" / LJ KWHUVXUIDFHV UHIOHFWPRUH KHDWDQGDEVRUEOHVV VR WKH LU WHPSHUDWXUHV UHPD LQ ORZHU UHGXFLQJ VXUIDFHVWKDWPRKHWVXUIDFH	1	0
' RHV WKH VLWH KDYH H[LVWLQJ WDOO WUHH VRU EXLOGLQJV WKDW ZLOO VKDGH VRODU H[SRVHG JODJHG DUHDV " 6 KDGLQJ FRQWHDVWVRVKDQQGZHDWI DFLQJDUHDVFDQUHGXFH VRODUJDLQV EXWPD\DOVRUHGXFHGD\OLJKWOHYHOV	1	1

Scheme characteristics and dwelling design

$ UH WKH GZHOOLQJ VÁDWV ") ODWVRIWHQFRPELQHQHDQXP EHURI I DFWRUV FRQWULEXWLQJWRRYHUKHDWLQJULVNVJKHDWGZHOOLQJV LQ]HHGHDW JDLQVIURPV XUURXQGLQJDUHDVRWKHUGZHOOLQJVDQGFRUULGRUVDQGHFRQRPLFDOFRQVWUDLQWVVR GZ HOOLQJV PD\ EHVLPLODU LQ DI ID FWHG VHH JXLGDQFH IRU H[DP SOHV	3	0
' RHV WKH VFK HPH KD YH FRPPXQLW\ K H D WLQJ " LHVWKHSLSHZRUNRQKHDWLQJ DQGRUKRWZDWHU VHUYLQJ PXOWLSOH GZHOOLQJV ZLWK LQWHUQDOFRUULGRUVOHDGLQJWRKHDWJDLQVLQWKHPHUHDWXUHV	3	0

#1' RG ZHOO LQJVK DYH KLJ KH[SRVHG WKHUPDO PDVV¬ $ 1 ' DPHDQV IRU HDUO\ FRROLQJ ZLWK DLU FKDQJHV" 7 KHUPDO PDVV FDQ KHOS WR GHOD\ WHPSHUDWXUHSHDNV EXW FDQDOVR FDXVHSURSHUWLHVWREHVORZHUWRFRROGRZQHVSHFLDOO\ XVHG ZLWKFDUHVHHJXLGDQFH		1	0
' R ÁRRU WR FHLOLQJ KHLJKWV DOORZ FHLOLQJ IDQV QRZ RU LQ WKH IXWXUH" + LJKHUFHLOLQJVLQFUHDVHVWUDWLILFDWLRQDQGDLU PRYHPHQWDQGRIIHUWKHSRWHQWLDO IRUFHLOLQJ IDQV	! PDQ IDQLQ WDOOHG	2	0
	! P	1	

Solar heat gains and ventilation

: KDW L V WKH HVWL PDWHG DYHUDJH J OD]L QJ UDWLR IRU WKH GZ HOO LQJV" DVDSURSRUWLRQRIWKHIDFDGHDUHD[SRVHG DUHDVRHORQJVWDWLRQVDFLQJDWVRXWKHDVWDQG DQ\WKLQJLQEHWZHHQ+LJKHU SURSRUWLRQ RIJOD]LQJ DOORZ KLJKHU KHDW JDLQV LQWR WKH VSDFH	>65%	12	4
	>50%	7	
	>35%	4	

, V WKHUH XVH RI H[WHUQDO VKDGLQJ" 6 KDGLQJ VKRXOGDSSO\ WRVRXWKHDVW WRZHVWIDFLQJ ,QFOXGH EDOFRQLHV DERYHDQGHDUDWIDFDGHDUHDWLRQFRQFHQWUDWLRQ IXOOVSSDUWRFURVLGHSHQGRQOD]LQJ SURSRUWLRQVDSHU #6		Full	Part	0
	>65%	6	3	
	>50%	4	2	
	>35%	2	1	

$ UH WKH GZHOOLQJ V VLQJ OHDVSHFW" 6 LQJOHDVSHFWGZHOOLQJV KDYHDOO RSHQLQJV¬¬¬¬ RQWKHVDPHI DFDGH7KLVUHGXFHVWKH¬¬¬¬ SRWHQWLDO RUYHQWLODWLRQ	Single-aspect	3	0
	Dual aspect	0	

' RZ LQG RZ V RSH QLQ JV VX SSRUW HIIHFWLYH YHQWLODWLRQ" LargerHIIHFWLYHDUHD VHFXUHRSHQLQJVZLOO KHOSGLVSHOWKHDW VHHJXLGDQFH	Openings compared to Part F purge rates			3
		= Part F	+50% +	
	Single-aspect	minimum required	3	4
	Dual aspect		2	3

TOTAL SCORE	7	=	Sum of contributing factors:	12	minus	Sum of mitigating factors:	5

High — 12 — Medium — 8 — Low

VF R UH!	VF R UH EH WZH HQ D QG	VF R UH
Incorporate design changes to reduce risk factors and increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	Seek design changes to reduce risk factors and/or increase mitigation factors AND Carry out a detailed assessment (e.g. dynamic modelling against CIBSE TM59)	Ensure the mitigating measures are retained, and that risk factors do not increase (e.g. in planning conditions)

Appendix D

Water Consumption Calculations

breglobal

Job no:	
Date:	09/06/2022
Assessor name:	Tom Reynolds
Registration no:	
Development name:	33a Gypsy Lane
Issue Date:	

Rainwater **Greywater** **Results**

WATER EFFICIENCY CALCULATOR FOR NEW DWELLINGS

(for use with the Code for Sustainable Homes issues Wat 1 for the May 2009 and subsequent versions)

Dwelling Description 33a Gypsy Lane

1st step - Select from options below:

Is a Rain and/or Greywater system specified?	**No**
Is a shower AND bath present?	**Yes**
Has a washing machine been specified?	**No**
Has a dishwasher been specified?	**No**

2nd step - Build spreadsheet (click button below)

BUILD SPREADSHEET

As soon as this button is pressed the spreadsheet will change according to the options selected previously in the 1st step. Scroll down to see the changes.

3rd step - Enter consumption details for the specified fittings

TAPS (excluding kitchen taps)	Fitting type	Flow rate (litres/min)	Number of fittings
1	Basin Taps	6.00	2
2			
3			
4			
		Proportionate flow rate (litres/min)	4.20
		Consumption / person / day (Litres)	**11.06**

BATHS		Fitting type	Capacity to overflow (litres)	Number of fittings
	1	Bath	170.00	1
	2			
	3			
	4			
			Proportionate capacity to overflow (litres)	119.00
			Consumption / person / day (Litres)	**18.70**

SHOWERS		Fitting type	Flow rate (litres/min)	Number of fittings
	1	Shower	8.00	2
	2			
	3			
	4			
			Proportionate flow rate (litres/min)	5.60
			Consumption / person / day (Litres)	**34.96**

DISHWASHER	
Where no dishwasher is specified, a default consumption figure of 1.25 litres per place setting is used.	
Consumption / person / day (Litres)	**4.50**

WASHING MACHINES		Number of fittings
Where no washing machine is specified, a default consumption figure of 8.17 litres per kilogram of dry load is used.		
Where no washing machines have been specified but plumbing for future supply of grey/rainwater was installed, please enter details:		
	Consumption / person / day (Litres)	17.16

WC's	Fitting Type	Flush Type	Volume**	Number of fittings
1	WC	Full Flush	4.00	2
		Part Flush	2.60	
2		Full Flush		
		Part Flush		
3		Full Flush		
		Part Flush		
4		Full Flush		
		Part Flush		
		Average effective flushing volume (litres)		3.06
		Consumption / person / day (Litres)		13.53

KITCHEN SINK TAPS	Fitting Type	Flow rate (litres/minute)	Number of fittings
1	Kitchen Tap	8.00	1
2			
3			
4			
	Proportionate flow rate (litres/min)		5.60
	Consumption / person / day (Litres)		**13.88**

WASTE DISPOSAL UNIT	
Is a waste disposal unit specified for the dwelling?	No
Consumption / person / day (Litres)	**0.00**

WATER SOFTENER	
Water Softener in use?	No
Total capacity used per regeneration (%)	
Water consumed per regeneration (litres)	
Average number of regeneration cycles per day (No.)	
Number of occupants served by the system (No.)	
Water consumed beyond 4% person / day (Litres)	**0.00**

4th step - Analyse Results	Go to Start

INTERNAL WATER CONSUMPTION		
NET INTERNAL WATER CONSUMPTION	(litres/person/day)	**113.79**
RAINWATER ONLY COLLECTION SAVING	(litres/person/day)	**0.00**
GREYWATER ONLY RECYCLING SAVING	(litres/person/day)	**0.00**
RAIN/GREYWATER COLLECTION SAVING (combined system)	(litres/person/day)	**0.00**
NORMALISATION FACTOR	(litres/person/day)	**0.91**
TOTAL WATER CONSUMPTION	(litres/person/day)	**103.6**
	CSH CREDITS ACHIEVED	**3**
	CSH MANDATORY LEVEL:	**Level 3/4**

17. K COMPLIANCE		
EXTERNAL WATER USE	(litres / person / day)	5.00
TOTAL WATER CONSUMPTION	(litres / person / day)	**108.6**
	17. K COMPLIANCE?	**Yes**

PRINTING: before printing please make sure that in "Page Setup" you have selected the page to be as "Landscape" and that the Scale has been set up to 75% (maximum)

Appendix E

East Herts District Council Sustainability Checklist https://www.eastherts.gov.uk/planning-building/make-planning-application.

Reference	Checklist Criteria	Summary of approach to address the criteria
Energy and Carbon Reduction		
En.1	Does the Sustainable construction, Energy and Water Statement detail how the proposed development's carbon emissions have been minimised and to what extent? Have full and reserved matters planning applications also included a carbon reduction template within the statement? (*See SPD section 3.3 and appendix B*)	&DUERQHPL VVLRQVKDYHEHHQ UHGXFHGE 2R YHUWKHSDUW EDVHOLQH7KLVKDVEHHQ DFKLHYHGWKURXJKDQLPSURYHG EXLOGLQJIDEULF 4DQGWKH XVHRIDKHDWSXPSWRSURYLGH VSDFHDQG +:KHDWLQJ
En.2	How have the site layout and building orientation and form been designed to minimise energy use? For example passive solar gain, natural shade, natural ventilation, thermal mass. *(See SPD section 3.2.3)*	7KHRULHQWDWLRQRIWKHGZHOOLQJ ZLWKWKHODUJHVWDUHDRIJOD]LQJ IDFLQJVRXWKSURYLGHVVRODU JDLQ7KHXVHRIODUJHRSHQLQJV IRUQDWXUDOSXUJHYHQWLODWLRQ DVVLVWZLWKSDVVLYHQLJKWWLPH FRROLQJ. Openings on both sides of the dwelling enable cross-ventilation to assist this process.
En.3	How has the energy hierarchy been applied to prioritise reducing the need for energy and implementing the 'fabric first approach'? *(See SPD section 3.2.3)*	$QLPSURYHGEXLOGLQJIDEULFKDV UHGXFHGFDUERQHPLVVLRQVE\ XVLQJSDVVLYHPHDQV7KH XVHRIDKHDWSXPSWRSURYLGH VSDFHDQG +:KHDWLQJWKHQ SURYLGHVDQDGGLWLRQDO 8 UHGXFWLRQ

En..4	How will you ensure that where renewable/ low carbon technologies have been included to reduce carbon, that these will be successfully integrated into the design of the development? *(See SPD sections 3.2.4 and 3.2.5)*	Design of the heat pump and underfloor systems will be undertaken by the same party (as recommended by the Energy Saving Trust). The heat pump will be suitably sized for the demand - which will be low due to the insulation uplift over Part L 2013 - and will be commissioned by a suitable specialist pre-completion.
En..5	How has the energy embodied in construction materials been reduced? (e.g. reuse and recycling/ sustainable materials/ locally sourced) *(See SPD section 3.2.6)*	Demolition material will be re-used on site where possible. New materials will be sourced locally wherever possible. Materials with a low embodied carbon (timber, low-carbon cement, for example) will be specified wherever possible.
Climate Change Adaptation		
CA.1	How has the site layout and buildings been designed to mitigate overheating, giving priority to measures in line with the cooling hierarchy? (*See SPD section 4.2.2*)	7KHGXDODVSHFWQDWXUHDOORZVFURVV YHQWLODWLRQDQGWKHDUHVL]LQJRI the IORRUSODQVHQDEOHZLQGRZVHQDEOHVVHFXUH QLJKWWLPHYHQWLODWLRQZLWKVLJQLILFDQWDLU FKDQJHVSHUKRXU
CA.2	How has overheating assessment been assessed and what measures are proposed to address it? (*See SPD section 4.2.2*)	2YHUKHDWLQJULVNKDVEHHQDVVHVVHG XVLQJWKH*\$2YHUKHDWLQJWRRO7KH GHYHORSPHQWVXUURXQGLQJPDWLRSURYLGHV VLJQLILFDQWLPSDFWRQWKHRYHUKHDWLQJULVN DQGDQXSOLIWWRYHQWLODWLRQRYHUWKH 3DUW/UHTXLUHGYLDRSHQDEOHZLQGRZV PLWLJDWHVWKHUHPDLQLQJULVN
CA.3	What Green Infrastructure is proposed? (*See SPD section 4.2.3*)	6LJQLILFDQWDPRXQWRIQDGHQSODQWLQJZLOO PLQLPLVHWKHDPRXQWRIKDUGVXUIDFHLQ WKHGHYHORSPHQW

CA.4	How have existing landscape features such as trees/woodlands and hedgerows been protected and incorporated within a Green Infrastructure network? (*See SPD section 4.2.3*)	7KHH[LVWLQJWUHHVWRWKH SRLQWWKH VLWHDUHWREHUHWDLQHG DQGSURWHFWHGGXULQJWKH FRQVWUXFWLRQ7KHVHZLOOFUHDWHDQ JUHHQLQIUDVWUXFWXUHRQWKHVLWH
CA.5	Where feasible and appropriate, have green roofs or walls been included. Please explain your answer? (*See SPD section 4.2.3*)	* LYHQWKHSURSRVHGGHVLJQLWLV QRWIHDVLEOHWRLQFOXGHHLWKHU JUHHQURRI VRUZDOOVDVSDUWRI WKHGHYHORSPHQW
CA.6	Have measures been included to address surface water runoff? (*See SPD section 4.2.4*)	7KHPLQLPLVDWLRQRIKDUG VXUIDFHVDQGWKHPDLQWHQDQFH RIODUJHJUHHQDUHDVZLOOKHOS VXUIDFHUXQRIIWRPLQLPXP
CA.7	If the application is major development, have details of SUDs been submitted? (*See SPD section 4.2.4*)	7KHSURSRVDOLVRQDVLQJOH GZHOOLQJLVQRWFRQVLGHUHGWREH PDMRUGHYHORSPHQW
Water Efficiency		
Wa.1	For new residential proposals, have you demonstrated compliance with the target for mains water consumption to be 110 litres or less per heard per day in the Sustainable construction, Energy and Water Statement? (*See SPD section 5.2.2*)	<HVDSHFLILFDWLRQKDVEHHQ SURYLGHGWKDWDFKLHYHVWKHO SHUVRQGD\WDUJHW

Wa.2	For non-residential development, have measures been taken to reduce water consumption in the proposed development? (*See SPD section 5.2.3*)	QD
Wa.3	Have water recycling systems been considered and incorporated? Please explain your approach (*See SPD section 5.2.4*)	1 RWDVWKHVHDUHQRWFRQVLGHUHG DSSURSULDWHIRUWKLVVFDOHRI GHYHORSPHQW
Pollution: Air Quality		
AQ.1	How has the proposal addressed the minimum air quality standards? These apply to all new development as set out in section 6.1.2.2 of the SPD.	Figure 9 would suggest that as this is a minor development and is not located in an Air Quality Management Area that no further assessment is required.
AQ.2	How does the proposal show consideration of air quality in the design of new development? Design should address the following principles: • Building and development layout and design • Emissions from transport • Sustainable energy (*See SPD section 6.1.2.4*)	The use of heat pumps eliminates the NOx and particulate emissions associated with boilers or biomass. Provision of electric car charging points will assist in the reduction of emissions associated with transport.

AQ.3	How has emissions mitigation been incorporated into the proposal? (*See SPD section 6.1.2.5*)	The use of heat pumps and the retention of green infrastructure will minimise any emissions locally to the site.
AQ.4	How will emissions be minimised through the construction and demolition phase of the development? Measures should follow the national guidance set out in section 6.1.2.7 of this SPD.	
AQ.5	Has an Emissions Assessment been carried out as part of the Air Quality Neutral Requirement? The assessment should utilise the Damage Cost Approach.	No, the development is minor and not located in an Air Quality Management Area.
AQ.6	Has an Air Quality Impact Assessment been submitted? This must be submitted if the proposal meets any of the criteria listed in section 6.1.3 of this SPD.	No, the development is minor and not located in an Air Quality Management Area.
AQ.7	Has an Air Quality Neutral Assessment been submitted? This must be submitted if the proposal meets the criteria listed in section 6.1.3 of this SPD.	No, the development is minor and not located in an Air Quality Management Area.

Pollution: Light Pollution		
LP.1	Does the proposal materially alter light levels outside the development and/or have the potential to adversely affect the neighbouring uses or amenity of residents and road users or impact on local ecology? (*See SPD section 6.2.2*)	
LP.2	Is the proposed light design the minimum required for security and operational purposes? (*See SPD section 6.2.2*)	
LP.3	Does the proposal minimise potential glare and spillage? Please detail the design measures adopted to ensure this (*See SPD section 6.2.2*)	
Biodiversity		
Bio.1	Have you submitted the East Herts biodiversity checklist? (*See SPD section 7.3*)	
Bio.2	In accordance with the biodiversity checklist, does the proposal affect a protected species or habitat?	

	(*See SPD sections 7.2.4 and 7.3*)	
Bio.3	If a protected species or habitat has been identified, has an ecological survey, with sufficient information been undertaken? (See *SPD sections 7.2.4 and 7.3*)	
Bio.4	If major development, has an ecological survey, with sufficient information been undertaken to assess the likely ecological impact of the development? *(See SPD sections 7.2 and 7.3*)	
Bio.5	Has the mitigation hierarchy been undertaken, to demonstrate an adverse impact on biodiversity has been avoided? If this is not possible, has the impact been mitigated and then subsequently compensated? (See SPD section 7.2.2)	
Bio.6	Has a biodiversity net gain been achieved? Please explain *(See SPD section 7.2.5*)	

Bio.7	Has a suitable biodiversity management and monitoring strategy for the site been proposed?	
Sustainable Transport		
T.1	Have you demonstrated that the development includes measures that reduce the overall need to travel, and particularly by private car? (*See SPD section 8.2.2*)	
T.2	Have you demonstrated how, as first principles of design, the scheme's proposals prioritise walking and cycling within the development and link with existing networks beyond the development to deliver healthy and walkable neighbourhoods? (*See SPD section 8.2.3*)	
T.3	Where cycling facilities and any bus stops and/or transport hubs are to be provided, have you demonstrated that they accessible and attractive for all users and offer appropriate shelter? (*See SPD section 8.2.3*)	
T.4	Have you included measures (traditional and/or innovative) to encourage uptake of more sustainable modes of	

	transport and engender modal shift from the outset of development? (*See SPD sections 8.2.2 and 8.2.3*)	
T.5	Have you developed and submitted to HCC an appropriate Travel Plan, Transport Assessment and/or Statement (as appropriate)? (*See SPD section 8.2.4*)	
T.6	Where car parking is to be provided, have you provided justification for the number of spaces proposed and made provision for electric vehicle charging in accordance with the Vehicle Parking Provision at New Developments SPD? (*See SPD section 8.2.5*)	
Waste Management		
W.1	Have measures been proposed to reduce, re-use and recycle construction and demolition waste? (*See SPD sections 9.2.2 and 9.2.3*)	
W.2	As relevant, how has the internal and external design of the development factored in effective	

	sustainable waste management measures? Has sufficient detail been submitted with the application? (*See SPD section 9.2.4*)	
W.3	Have all the relevant criteria identified in Table 13 of the SPD been addressed? *(See SPD section 9.2.4)*	