PRICE&MYERS

Charlotte Street, 64, Camden
Sustainability Statement

CIBSE LOW CARBON ENERGY ASSESSORS

Date: 20 November 2015

Project number: 22995.001

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1 Introduction

Price & Myers have been commissioned by Roland Cowan Architects, on behalf of Cyclemight Ltd. to produce a Sustainability Statement for the proposed mansard roof extension at 64 Charlotte Street.

The site is an existing 19th Century 4 storey plus basement property situated on the corner of Charlotte Street and Tottenham Street within the London Borough of Camden. It is located within the Charlotte Street Conservation Area but it is not listed.

The proposal involves the construction of a new mansard roof extension on top of the existing building to create a 3 bedroom dwelling.

The scheme has been designed to address all feasible sustainability issues, in line with the London Borough of Camden's sustainability policies.

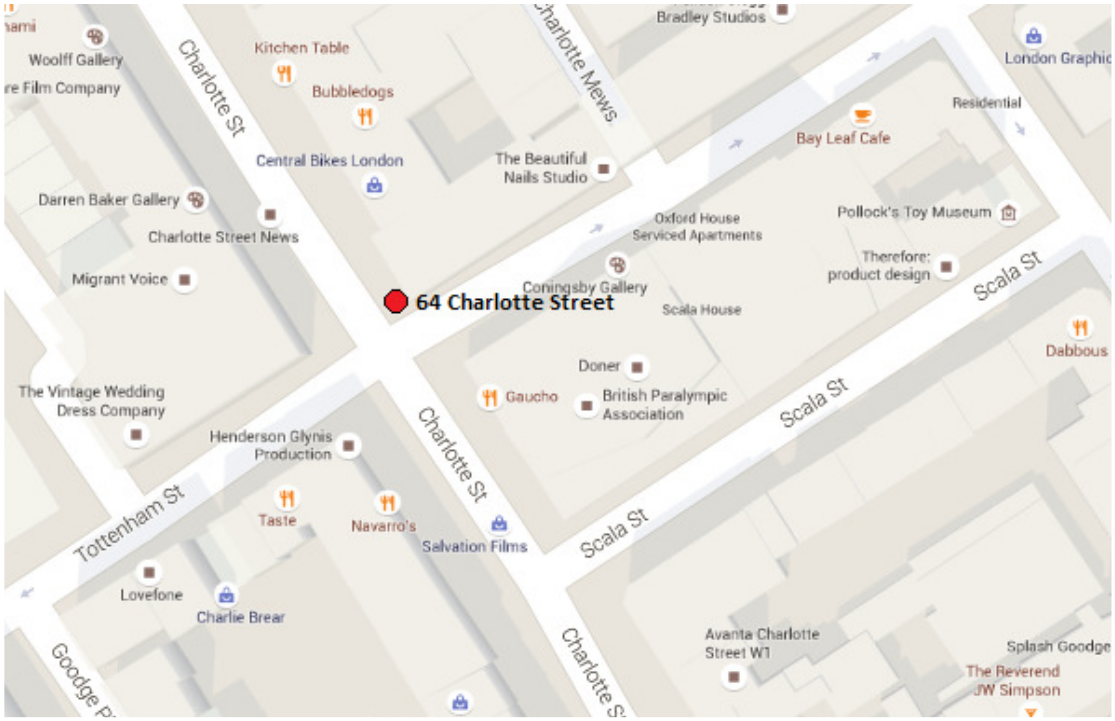

Figure 1.1 - Google Map extract indicating site location of 64 Charlotte Street

The proposals have been designed and specified in accordance with the following relevant planning policies where feasible, and will provide a good level of energy efficiency and sustainability for a development of this type and size.

2 Policy

2.1 The London Plan, Adopted July 2011

Policy 5.2: Minimising Carbon Dioxide Emissions
Planning Decisions

Policy states that development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

1. Be Lean: use less energy
2. Be Clean: supply energy efficiently
3. Be Green: use Renewable energy

2.2 Camden Core Strategy 2010 – 2025, Adoption Version 2010

CS13 - Tackling climate change through promoting higher environmental standards

Reducing the effects of and adapting to climate change
The Council will require all development to take measures to minimise the effects of, and adapt to, climate change and encourage all development to meet the highest feasible environmental standards that are financially viable during construction and occupation by:
a) ensuring patterns of land use that minimise the need to travel by car and help support local energy networks;
b) promoting the efficient use of land and buildings;
c) minimising carbon emissions from the redevelopment, construction and occupation of buildings by implementing, in order, all of the elements of the following energy hierarchy: - ensuring developments use less energy, - making use of energy from efficient sources, such as the King's Cross, Gower Street, Bloomsbury and proposed Euston Road decentralised energy networks; - generating renewable energy on-site; and
d) ensuring buildings and spaces are designed to cope with, and minimise the effects of, climate change. The Council will have regard to the cost of installing measures to tackle climate change as well as the cumulative future costs of delaying reductions in carbon dioxide emissions

Local energy generation
The Council will promote local energy generation and networks by:
e) working with our partners and developers to implement local energy networks in the parts of Camden most likely to support them, i.e. in the vicinity of: - housing estates with community heating or the potential for community heating and other uses with large heating loads; - the growth areas of King's Cross, Euston; Tottenham Court Road; West Hampstead Interchange and Holborn; - schools to be redeveloped as part of Building Schools for the Future programme; - existing or approved combined heat and power/local energy networks (see Map 4); and other locations where land ownership would facilitate their implementation.
f) protecting existing local energy networks where possible (e.g. at Gower Street and Bloomsbury) and safeguarding potential network routes (e.g. Euston Road);

Water and surface water flooding

We will make Camden a water efficient borough and minimise the potential for surface water flooding by:
g) protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;
h) making sure development incorporates efficient water and foul water infrastructure;
i) requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross (see Map 5).

Camden's carbon reduction measures

The Council will take a lead in tackling climate change by:
j) taking measures to reduce its own carbon emissions;
k) trialling new energy efficient technologies, where feasible; and
l) raising awareness on mitigation and adaptation measures.

2.3 Camden Development Policies, Adoption Version 2010

Policy DP22 - Promoting sustainable design and construction

The Council will require development to incorporate sustainable design and construction measures. Schemes must:
a) demonstrate how sustainable development principles, including the relevant measures set out in paragraph 22.5 below, have been incorporated into the design and proposed implementation; and
b) incorporate green or brown roofs and green walls wherever suitable.

The Council will promote and measure sustainable design and construction by:
c) expecting new build housing to meet Code for Sustainable Homes Level 3 by 2010 and Code Level 4 by 2013 and encouraging Code Level 6 (zero carbon) by 2016.
d) expecting developments (except new build) of 500 sq m of residential floorspace or above or 5 or more dwellings to achieve "very good" in EcoHomes assessments prior to 2013 and encouraging "excellent" from 2013;
e) expecting non-domestic developments of 500sqm of floorspace or above to achieve "very good" in BREEAM assessments and "excellent" from 2016 and encouraging zero carbon from 2019.

The Council will require development to be resilient to climate change by ensuring schemes include appropriate climate change adaptation measures, such as:
f) summer shading and planting;
g) limiting run-off;
h) reducing water consumption;
i) reducing air pollution; and
j) not locating vulnerable uses in basements in flood-prone areas.

Policy DP23 – Water

The Council will require developments to reduce their water consumption, the pressure on the combined sewer network and the risk of flooding by:
a) incorporating water efficient features and equipment and capturing, retaining and re-using surface water and grey water on-site;
b) limiting the amount and rate of run-off and waste water entering the combined storm water and sewer network through the methods outlined in part a) and other sustainable urban drainage methods to reduce the risk of flooding;
c) reducing the pressure placed on the combined storm water and sewer network from foul water and surface water run-off and ensuring developments in the areas identified by the North London Strategic Flood Risk Assessment and shown on Map 2 as being at risk of surface water flooding are designed to cope with the potential flooding;
d) ensuring that developments are assessed for upstream and downstream groundwater flood risks in areas where historic underground streams are known to have been present; and
e) encouraging the provision of attractive and efficient water features.

The Code for Sustainable Homes

The Government have announced the official withdrawal of the Code for Sustainable Homes. The Deregulation Bill has been given Royal Assent. In the Ministerial Statement, the following was confirmed:
The government's policy is that planning permissions should not be granted requiring, or subject to conditions requiring, compliance with any technical housing standards other than for those areas where authorities have existing policies on access, internal space, or water efficiency.
The development follows similar sustainable design and construction principles as those included in the CSH, as outlined below, but a formal pre-assessment has not been undertaken.

3 Sustainability Appraisal

The following appraisal addresses the sustainable features of the proposed development, following policy guidelines.

3.1 Energy efficiency; vacant & underused land and buildings

Underused Land/Buildings
The existing 19th century building is currently being refurbished. The works include complete internal demolition, with Façade Retention, and internal re-building to create 6 new residential units to the upper levels and Office space to the Ground and Basement levels.

The proposed mansard roof extension will utilise the otherwise unused external roof space, designed to preserve and enhance the character and appearance of surrounding buildings and areas in the borough.

Passive design
As part of the Be Lean approach, passive design measures have been considered throughout the pre-planning stage to reduce energy demand where possible. The orientation of the development is south westerly facing. All thermal elements of the building will be specified to exceed Building Regulations minimum standards. The existing building's structure is primarily reinforced concrete formwork. This has a high thermal mass and will benefit the mansard extension through night-time free cooling, thus assisting in the reduction of energy consumption.

Solar gain control & daylighting
The development has been designed to balance the use of solar gain to reduce reliance on space heating whilst ensuring that the gains do not result in summer overheating. The U-Values of all glazed elements will exceed Building Regulations standards, and incorporate low emissivity coating, resulting in an efficient balance between passive solar gain and the thermal losses from each room.

Where possible, windows and natural daylight have been provided to ensure appropriate daylighting levels throughout the development and reduce the lighting demand. The size and orientation of external windows has been considered carefully to balance daylight with excessive solar gains.

The impact of solar gains has been incorporated into the SAP analysis for compliance with Part L and the risk of solar overheating has been concluded to be not significant for the majority of the development. In order to mitigate this risk; light-coloured curtains or roller blinds will be provided for shading.

Ventilation
Other than mandatory ventilation to meet AD Part F, the development utilises natural ventilation in the form of openable windows. The impact of solar gains has been incorporated into the SAP analysis for compliance with Part L and using a natural ventilation strategy the risk of solar overheating has been concluded to be not significant for the development.

Thermal performance

The thermal envelope will be designed to minimise heat loss by specifying low U-values and minimising thermal bridges where possible. The thermal fabric has been specified to meet or exceed current Building Regulations targets. Table 3.1 shows the U-values that will be considered for the development and have been assumed for the energy strategy analysis at this stage.

Element	U-Value - Proposed
External Walls (Party Wall Extension & New Mansard)	0.11 W/m2K
Roof	0.11 W/m2K
Windows	1.2 W/m2K
Roof Lights	1.2 W/m2K
Air Tightness (m3/m2/h)	Pressure test will be carried out to determine air tightness. This will be an assumed: 5 $m^3/m^2/h$

Table 3.1: Proposed passive design measures

Services Strategy

In order to minimise the heating of rooms whilst they are unoccupied and not in use, the heating system will be zoned to control at least the daytime living areas and bedrooms separately.

All white goods provided to the property will be specified to be efficient with an A rating or better in order to reduce electrical loads and water consumption.

Energy efficient equipment has been proposed where possible to support the services strategy. Tables 3.3 below summarises the proposed services strategy and energy efficiency measures for the development.

Services	Measure - Proposed
Space Heating	Condensing Regular Gas Boiler 92% Efficient Space heating from radiators
Heating Controls	Time and temperature zone control
Hot Water Heating	Condensing Regular Gas Boiler 92% Efficient
Ventilation	Natural Ventilation
Comfort Cooling	n/a
Lighting	100% low energy lighting
Lighting control	PIR/Daylight/timer controls fitted to lighting in external areas

Table 3.2: Proposed energy efficient design measures

Low or zero carbon technologies

Having reviewed potential LZC technologies for the development, high efficiency solar PV panels have been identified as the most viable system. The PV panels would most suitably be installed, horizontally on the flat roof space. Careful consideration will be required in siting the panels in a location that will not be overshadowed, which would reduce the efficiency of the panels. The chosen system should be accurately sized during the detailed design stages and MCS (Microgeneration Certification Scheme) approved equipment and installers used.

Table shows the proposed system size and the estimated energy and carbon emissions savings and financial feasibility for this development.

	Energy & CO_2				Life Cycle Carbon and Cost Analysis		
Proposed LZC Technologies	Energy Generated (kWh/yr)	% site energy demand met	CO_2 saved by system (kgCO2/yr)	% reduction in site CO_2 emissions	25 year CO_2 saving ($kgCO_2$)	Estimated capital cost	Payback period
Total Solar PV = 1 kWp Horizontal (approx. 10 deg) Approx. 4 panels Approx. gross array area = 6.56m²	1,515	14.12%	786	22.8%	19,652	£3,000 - 5,000	10-12 years

Table 3.3 Energy, carbon and financial performance of the proposed LZC technologies

Energy performance

The proposed residential units have been modelled using the approved Standard Assessment Procedure for the Energy Rating of Dwellings (SAP).

Tables 3.4 provides a summary of the energy performance of the proposed dwellings, showing the improvements over the existing achieved as a result of the proposed building envelope and M&E services upgrades.

Carbon emissions		Fabric Performance	
DER	14.80	DFEE	40.86
TER	14.20	TFEE	41.99
Improvement	**-4.23%**	**Improvement**	**2.70%**

Table 3.4: Summary of average SAP results

3.2 Materials

The design team have put a strong focus on sustainability and durability when considering construction profiles and building materials for the development. High Green Guide ratings will be achieved wherever possible for the parts of the external envelope and internal build elements and materials will be assessed for suitability with regards to environmental performance.

New insulating materials will be specified to maximise thermal performance whilst still paying attention to the environmental impact of the materials used. The incorporation of recycled products will be pursued wherever feasible and the use of other low embodied energy products will be further investigated.

Responsible sourcing will also be pursued. All timber used on site during the construction phase and within the building will be from FSC sources or equivalent. Other materials, including insulation, will be sourced from manufacturers who employ environmental management systems such as ISO 14001 or BES 6001. Where possible, materials will be sourced locally.

Non-toxic materials will be used wherever possible, including the specification of products with low VOC content in line with European testing standards.

A Site Waste Management Plan (SWMP) will be produced for the site, which will include a pre-refurbishment audit to determine how to maximise the recovery of materials from the refurbishment for subsequent high-grade/value applications.

3.3 Air pollution

Construction site impacts
The construction site will be managed in such a way that the environmental impact is minimised. This includes following best practice policies for dust pollution by using dust sheets, covering skips and damping down where appropriate.

The contractor will be obliged to sign up to the Considerate Constructors Scheme and comply with the requirements to minimise dust and smoke on site.

Plant and machinery
A 92% efficient, low NO_x emission condensing regular gas boiler will be installed within the dwelling. All plant and equipment installed in the development will be appropriately sized and selected for efficiency in order to reduce greenhouse gas emissions. All equipment will be frequently maintained to ensure it continues to run efficiently and cleanly.

3.4 Noise pollution

Construction site impacts
The construction site will be managed in such a way that the environmental impact is minimised. This includes following best practice policies to minimise noise pollution, including the use of quieter machinery where possible. Site working hours will be managed to mitigate the possibility that they will cause a nuisance to the surrounding properties.

Noise impact of the development
The development will comply with Building Regulations Part E, providing a good level of sound insulation between the development and the surrounding buildings. All windows will be double glazed to minimise the transmission of noise between the property and surrounding area.

3.5 Contaminated land

It is not thought that the site is contaminated. The proposed residential use will not involve the storage, processing or transfer of hazardous substances.

3.6 Water quality, saving and drainage

Flood risk and surface water drainage
The Environment Agency flood map confirms that the development site is not located within a zone at risk of flooding (Zone 1), with less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year.

As the whole site is currently hard-standing or occupied by the building, the proposed mansard extension is to be constructed above 4th floor level and will not increase the impermeable surface area and the subsequent volume of surface water inflow from surface run-off.

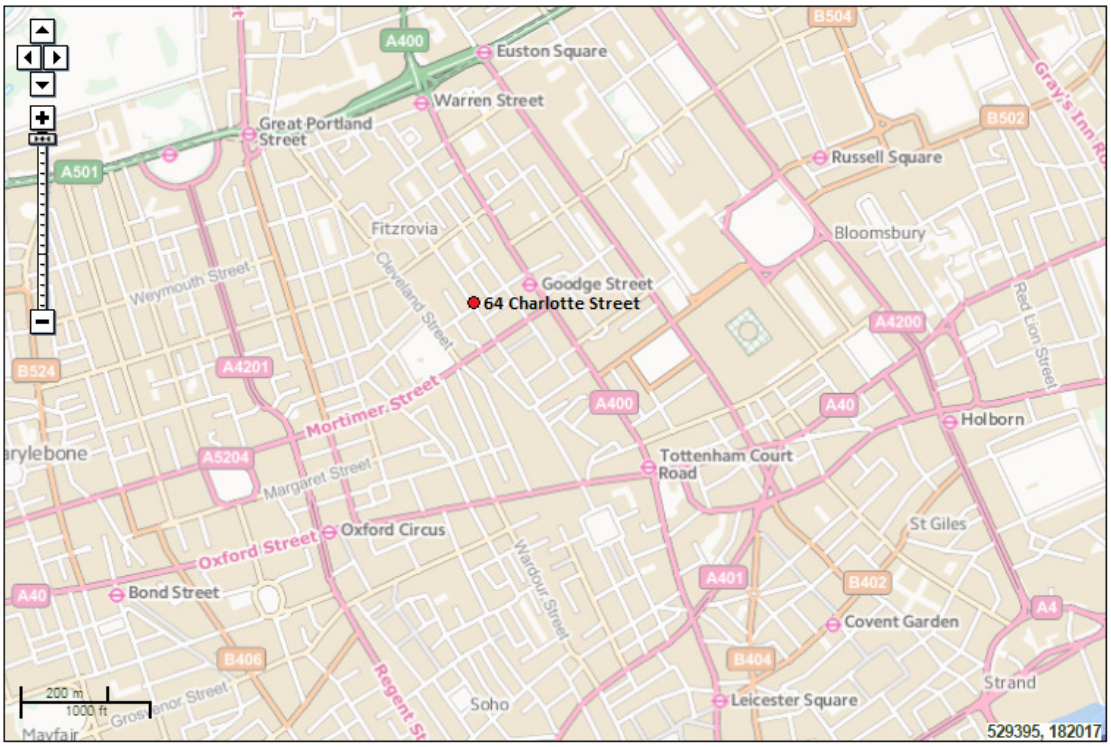

Figure 3.1 - Flood risk map (© Environmental Agency)

Water consumption
Internal potable water use will be limited to a maximum of 110 l/person/day through the specification of low flow fittings, dual flush toilets and smaller baths. All white goods provided will have maximum water efficiency ratings.

The following specifications will be considered in order to meet the water consumption target for the domestic unit:

- Taps - 5 l/min
- Baths - 160 litre overflow
- Showers - 10 l/min
- Dishwasher - 1.25 l/place setting
- Washing machine - 8l/kg load
- WC - 4/2.6 litre dual flush
- Kitchen taps - 5 l/min

Construction site impacts
The construction site will be managed in such a way that the environmental impact is controlled and minimised. Best practice guidelines for preventing water pollution will be followed on site.

3.7 Light pollution

100% of all the new lighting will be specified low energy lighting. All external lighting will be adequately controlled to ensure that spaces are only lit out of daylight hours and when the area is occupied. As the proposed building use is residential; there will be no illuminated signage or uplighting incorporated. The building is in a highly urbanised location, and therefore will significantly not contribute to increasing the effects of light pollution.

3.8 Waste and recycling

Site waste management
A construction site waste management plan will be developed and implemented to ensure that construction site waste is effectively reduced and recycled, including designing waste out from the initial stages. Material ordering control and modern construction methods will be employed to minimise the potential for waste on site.

The following benchmarks will be used, which have been set in line with the Code for Sustainable Homes methodology:

- Construction waste diverted from landfill:
- Non-hazardous construction waste; 85% by weight or volume
- Non-hazardous demolition waste; 80% by volume or 90% by tonnage

Waste will either be segregated on site into at least 5 different streams for recycling or collected, sorted and recycled by an external recycling contractor. Re-use of construction waste will also be encouraged. The site waste management plan will also ensure that hazardous waste is properly managed.

Operational waste management
The recycling of household waste once the building is occupied will also be encouraged through the provision of recycling facilities and dedicated internal and external storage for recyclable materials, separate to those for domestic refuse. A dedicated internal bin store with access from Tottenham Street will be provided for the storage of refuse and

recycling. The minimum size requirements for bins will be met with compliant access for weekly Local Authority collection

The London Borough of Camden provides a mixed recycling collection service collecting most types of recyclable waste. Due to the size of the development, communal waste storage containers will be provided as detailed below:

- As per Camden planning Guidance CPG1, 100lt of bin space split evenly between refuse and recycling is to be provided within the communal bin store for the 1 bedroom mansard dwelling

Additional storage space will also be required for redundant bulky household goods, such as refrigerators/freezers, furniture, cookers and electrical equipment, much of which could be reusable.

3.9 Amenity, environmental quality, daylight and sunlight

The proposed development is located on a busy street in Fitzrovia. It is largely surrounded by a mixture of offices, retail and residential houses or flats that are of the same height or taller. Though the proposal includes a height increase, it is therefore not thought that there will be significant impact on sunlight or micro-climate of the area.

The principles of Lifetime Homes are to be included in the development and design of the project.

The development will be designed to incorporate good levels of daylight where possible through the redesign of the layout.

3.10 Open land

This issue is not applicable to the proposed development as it is not located in an area that would affect Royal Parks, Metropolitan Open Land or public amenity space or within a nature conservation area.

3.11 Trees, shrubs and landscape

The development is to be constructed entirely on the roof of the existing building which is 100% hardstanding and contains no features of ecological value.

3.12 Habitats and wildlife

Site constraints mean there are limited opportunities to incorporate landscaping and habitat creation into the development;

3.13 Archaeology

The project is being constructed entirely on the roof of the existing 4 storey building plus existing basement.

4 Conclusion

The measures described above, plus any additional measures outlined by the architect in the Design and Access Statement will be incorporated to improve the environmental performance of the building in response to London Borough of Camden's sustainable design requirements.

The efficient thermal envelope, M&E & renewable energy strategy proposed for the development show an improvement over current Building Regulations, which is summarised in the following table 4.1.

Carbon emissions		Fabric Performance	
DER	11.48	DFEE	40.86
TER	14.20	TFEE	41.99
Improvement	**19.15%**	**Improvement**	**2.70%**

Table 4.1: Summary of SAP results - Residential

The report also confirms that although the Government has now withdrawn the Code for Sustainable Homes. The development complies with the relevant standards of Policy DP22 including the former Code level 4 requirement of achieving a 19% improvement in DER/TER through the use of renewable technologies.

Internal potable water use will be limited to a maximum of 110 l/person/day through the specification of low flow fittings, dual flush toilets and a smaller bath in accordance with Camden policy DP23.

Appendix A

Sample Report Ltd
1 Sample Street
Sampletown

Full SAP Calculation Printout

Property Reference: 22995.001 **Issued on Date:** 18.Nov.2015
Survey Reference: PV (New Scheme) **Prop Type Ref:**
Property: 64, Charlotte Street, Camden, London, W1T 4QD

SAP Rating:	89 B	**CO2 Emissions (t/year):**	1.00	**DER:**	11.48 Pass	**TER:**	14.20	**Percentage DER<TER:**	19.15 %
Environmental:	90 B	**General Requirements Compliance:**	Pass	**DFEE:**	40.86 Pass	**TFEE:**	41.99	**Percentage DFEE<TFEE:**	2.70 %

CfSH Results **Version:** **ENE1 Credits:** N/A **ENE2 Credits:** N/A **ENE7 Credits:** N/A **CfSH Level:** N/A

Surveyor: admin Admin, Tel: 4, Fax: s@l.f Surveyor ID: Admin
Address:
Client:

Software Version: Elmhurst Energy Systems SAP2012 Calculator (Design System) version 3.01r13
SAP version: SAP 2012, Regs Region: England (Part L1A 2013), Calculation Type: New Dwelling As Designed

CALCULATION DETAILS for survey reference no 'PV (New Scheme)'
SAP2012 - 9.92 input data (DesignData) -


```
SAP2012 Input Data (Flat)      18/11/2015

FullRefNo:                     PV (New Scheme)

Regs Region:                    England
SAP Region:                     Thames Valley
Postcode:                       W1T 4QD
DwellingOrientation:            South East
Property Type:                  Flat, Semi-Detached
Storeys:                        1
Date Built:                     2015
Sheltered Sides:                2
Sunlight Shade:                 Average or unknown
Measurements                    Perimeter, Floor Area, Storey Height
    1st Storey:                41.82, 122, 2.31
Living Area:                    44.05 m2, fraction: 36.1%
Thermal Mass:                   Simple calculation
Thermal Mass Simple:            Medium
Thermal MassValue:              250
External Walls                  Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall Extension            27.48, 27.48, 0, Other, Solid, 0, 0.11, Calculate
New Slate Mansard               60.14, 69.12, 0, Other, Cavity, 0, 0.11, Gross
Party Walls                     Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1                    7.56, 0, Other, Solid, 0, 0
External Roofs                  Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
    External Roof 1            116.26, 122, 0, Other, 0.11
Heat Loss Floors                Area, Kappa, Construction, Element, Type, UValueFinal, ShelterFactor
Party Floors                    Area, Kappa, Construction, Element
    Party Floor 1              122, 0
Description                     Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
    Windows                    Manufacturer, Window, Double Low-E Soft 0.1, , , 0.63, , 0.7,
    Roof Lights                Manufacturer, Roof Window, Double Low-E Soft 0.1, , , 0.63, , 0.7,
Openings                        Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
    Opening 1                  Window, New Slate Mansard, South East, , None, 0, , 0, 0, 0, 6.98,
    Opening 2                  Window, New Slate Mansard, South West, , None, 0, , 0, 0, 0, 2.00,
    Opening 3                  Roof Window, External Roof 1, Horizontal, 0, None, , , 0, 0, 0, 5.74,
Conservatory:                   None
Draught Proofing:               100
Draught Lobby:                  No
Thermal Bridges
    Bridging:                  Default
    Y                          0.15
Pressure Test:                  True
Designed q50:                   5
AsBuilt q50:                    15
Property Tested:                False
Mechanical Ventilation          None
Chimneys MHS:                   0
Chimneys SHS:                   0
Chimneys Other:                 0
Chimneys Total:                 0
Open Flues MHS:                 0
Open Flues SHS:                 0
Open Flues Other:               0
Open Flues Total:               0
Intermittent Fans:              3
Passive Vents:                  0
Flueless Gas Fires:             0
Cooling System                  None
Light Fittings:                 15
LEL Fittings:                   15
Percentage of LEL Fittings:     100
External Lights Fitted:         Yes
External LELs Fitted:           Yes
Electricity Tariff:             Standard
Main Heating 1
    Description                Condensing Regular (BGB)
    Percentage                 100
    MHS                        Mains gas BGB Post 98 Regular condens. with auto ign.
    SAP Code                   102
    Boiler Efficiency Type     Sedbuk 2009
    Efficiency                 92
    Model Name                 tbc
    Manufacturer               tbc
    Controls by PCDF           0
    MHS Controls               CBI Time and temperature zone control
    Boiler Interlock           Yes
    Compensator                0
    Delayed Start Stat         Yes
```

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Ctrl SAP Code	2110
Burner Control	OnOff
Flue Type	Balanced
Fan Assisted Flue	Yes
Pumped	Pump in heated space
Heat Pump Age	2013 or later
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Main Heating 2	None
Heating Systems Interaction	Each system heats separate parts of dwelling
Smoke Control Area	Unknown
Community Heating	None
Secondary Heating	None
Water Heating	
Type	MainHeating1
WHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	
Cylinder Type	HotWaterCylinder
Cylinder Insulation Type	Foam
Cylinder Volume	200.00
Cylinder Stat	Yes
Pipeworks Insulated	Fully insulated primary pipework
Cylinder in Heated Space	Yes
Separate Time Control	Yes
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	More Dwellings, One Block
Apportioned Energy	780
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

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

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DWELLING AS DESIGNED

Top-floor flat, total floor area 122 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 14.20 kg/m²
Dwelling Carbon Dioxide Emission Rate (DER) 11.48 kg/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)42.0 kWh/m²
Dwelling Fabric Energy Efficiency (DFEE)40.9 kWh/m²OK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.11 (max. 0.30)	0.11 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.20 (max. 2.00)	1.20 (max. 3.30)	OK

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

---

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

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

Efficiency: 92.0% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

---

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

---

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

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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 South East: 6.98 m², No overhang
Windows facing South West: 2.00 m², No overhang

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Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

External wall U-value	0.11 W/m²K
External wall U-value	0.11 W/m²K
Party wall U-value	0.00 W/m²K
Roof U-value	0.11 W/m²K

Photovoltaic array

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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	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1065	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3565	(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) =	0.3030	(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	0.3863	0.3787	0.3712	0.3333	0.3257	0.2878	0.2878	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5530	0.5414	0.5414	0.5393	0.5459	0.5530	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.9800	1.1450	10.2824			(27)
Roof Lights (Uw = 1.20)			5.7400	1.1450	6.5725			(27a)
Party Wall Extension	27.4800		27.4800	0.1100	3.0228			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1100	6.6154			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1100	12.7886			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2818			(33)
Party Wall 1			7.5600	0.0000	0.0000			(32)
Party Floor 1			122.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	32.7900	(36)
Total fabric heat loss (33) + (36) =	72.0718	(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	53.4396	53.1701	52.9060	51.6654	51.4333	50.3528	50.3528	50.1527	50.7690	51.4333	51.9028	52.3937	(38)
Heat transfer coeff	125.5113	125.2419	124.9777	123.7372	123.5050	122.4245	122.4245	122.2244	122.8407	123.5050	123.9746	124.4655	(39)
Average = Sum(39)m / 12 =												123.7360	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0288	1.0266	1.0244	1.0142	1.0123	1.0035	1.0035	1.0018	1.0069	1.0123	1.0162	1.0202	(40)
HLP (average)												1.0142	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0513	21.9100	22.6092	19.7112	18.9134	16.3208	15.1236	17.3546	17.5619	20.4667	22.3410	24.2608	(46)

Water storage loss:	
Store volume	200.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0103 (51)
Volume factor from Table 2a	0.8434 (52)
Temperature factor from Table 2b	0.5400 (53)
Enter (49) or (54) in (55)	0.9372 (55)

Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

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Total heat required for water heating calculated for each month

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (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

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)

Total per year (kWh/year) = Sum(64)m = 2226.7983 (64)

Heat gains from water heating, kWh/month

	97.3824	86.3691	91.9691	84.1952	83.7768	76.6798	75.3761	80.3214	79.4308	87.2198	90.0245	95.6303 (65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	(66)

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

	27.9636	24.8370	20.1988	15.2918	11.4308	9.6504	10.4276	13.5541	18.1923	23.0993	26.9603	28.7408 (67)

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

	287.7945	290.7809	283.2553	267.2340	247.0101	228.0025	215.3043	212.3179	219.8435	235.8647	256.0886	275.0962 (68)

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

	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536 (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)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289 (71)

Water heating gains (Table 5)

	130.8904	128.5254	123.6144	116.9378	112.6032	106.4998	101.3120	107.9589	110.3206	117.2310	125.0340	128.5353 (72)

Total internal gains

	515.7093	513.2042	496.1293	468.5245	440.1049	413.2135	396.1047	402.8917	417.4172	445.2559	477.1438	501.4331 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Southwest	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(79)
Horizontal	5.7400	26.0000	0.6300	0.7000	1.0000	59.2334	(82)

Solar gains	160.2105	295.0246	454.0477	633.3285	764.0291	779.8929	743.1942	644.1681	516.8171	340.4599	196.1282	134.2577 (83)
Total gains	675.9198	808.2288	950.1769	1101.8530	1204.1341	1193.1064	1139.2988	1047.0598	934.2343	785.7157	673.2719	635.6909 (84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.5017	67.6469	67.7898	68.4695	68.5982	69.2036	69.2036	69.3169	68.9692	68.5982	68.3384	68.0688	
alpha	5.5001	5.5098	5.5193	5.5646	5.5732	5.6136	5.6136	5.6211	5.5979	5.5732	5.5559	5.5379	
util living area	0.9987	0.9961	0.9863	0.9447	0.8272	0.6340	0.4691	0.5293	0.8043	0.9739	0.9967	0.9990	(86)
MIT	19.8814	20.0461	20.3107	20.6398	20.8795	20.9786	20.9966	20.9936	20.9240	20.5900	20.1698	19.8521	(87)
Th 2	20.0594	20.0612	20.0630	20.0715	20.0731	20.0804	20.0804	20.0818	20.0776	20.0731	20.0699	20.0665	(88)
util rest of house	0.9982	0.9948	0.9816	0.9258	0.7767	0.5524	0.3731	0.4276	0.7311	0.9615	0.9954	0.9987	(89)
MIT 2	18.5568	18.7985	19.1833	19.6527	19.9587	20.0667	20.0792	20.0792	20.0182	19.5937	18.9861	18.5192	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.0351	19.2489	19.5904	20.0091	20.2912	20.3960	20.4104	20.4094	20.3453	19.9534	19.4135	19.0004	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8851	19.0989	19.4404	19.8591	20.1412	20.2460	20.2604	20.2594	20.1953	19.8034	19.2635	18.8504	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9929	0.9774	0.9206	0.7808	0.5676	0.3921	0.4477	0.7414	0.9567	0.9937	0.9981	(94)
Useful gains	674.1392	802.4749	928.6913	1014.4027	940.1617	677.2513	446.6818	468.7645	692.6605	751.7334	669.0272	634.4801	(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	1830.5915	1778.3021	1617.2559	1356.0519	1042.5300	691.2029	448.1287	471.7109	748.7450	1136.6675	1507.9650	1823.4734	(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	860.4005	655.7558	512.2921	245.9874	76.1620	0.0000	0.0000	0.0000	0.0000	286.3910	604.0352	884.6110	(98)
Space heating												4125.6350	(98)
Space heating per m2											(98) / (4) =	33.8167	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	92.9000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	4440.9419	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.4005	655.7558	512.2921	245.9874	76.1620	0.0000	0.0000	0.0000	0.0000	286.3910	604.0352	884.6110	(98)

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Space heating efficiency (main heating system 1)

92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)

Space heating fuel (main heating system)

926.1577	705.8728	551.4446	264.7873	81.9828	0.0000	0.0000	0.0000	0.0000	308.2788	650.1993	952.2185 (211)

Water heating requirement

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)

Efficiency of water heater 82.8000 (216)

(217)m 90.6538	90.3896	89.7911	88.3183	85.5838	82.8000	82.8000	82.8000	82.8000	88.6063	90.1685	90.7434 (217)

Fuel for water heating, kWh/month

241.9355	213.8732	226.1281	206.1134	208.4559	192.5519	184.9509	202.9136	202.5442	213.0318	221.3269	235.8893 (219)

Water heating fuel used 2549.7147 (219)

Annual totals kWh/year

Space heating fuel - main system 4440.9419 (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) 493.8454 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

Total delivered energy for all uses 7559.5020 (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	4440.9419	0.2160	959.2435	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2549.7147	0.2160	550.7384	(264)
Space and water heating			1509.9818	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	493.8454	0.5190	256.3057	(268)
Energy saving/generation technologies				
PV Unit	-780.0000	0.5190	-404.8200	(269)
Total CO2, kg/year			1400.3926	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.4800	(273)

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

DER		11.4800	ZC1
Total Floor Area	TFA	122.0000	
Assumed number of occupants	N	2.8707	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9788	ZC2
CO2 emissions from cooking, equation (L16)		1.5401	ZC3
Total CO2 emissions		26.9989	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		26.9989	ZC8

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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	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1419	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3919	(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) =	0.3331	(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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3331	0.3581	0.3748	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			8.9800	1.3258	11.9053			(27)
TER Room Window (Uw = 1.70)			5.7400	1.5918	9.1367			(27a)
Party Wall Extension	27.4800		27.4800	0.1800	4.9464			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1800	10.8252			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1300	15.1138			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.9274			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		10.9300 (36)
Total fabric heat loss	(33) + (36) =	62.8574 (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	54.8899	54.5641	54.2448	52.7449	52.4643	51.1580	51.1580	50.9160	51.6611	52.4643	53.0320	53.6255	(38)
Heat transfer coeff	117.7473	117.4215	117.1022	115.6023	115.3217	114.0154	114.0154	113.7735	114.5186	115.3217	115.8894	116.4829	(39)
Average = Sum(39)m / 12 =												115.6010	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9651	0.9625	0.9599	0.9476	0.9453	0.9346	0.9346	0.9326	0.9387	0.9453	0.9499	0.9548	(40)
HLP (average)												0.9475	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)											Total = Sum(45)m =	1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0513	21.9100	22.6092	19.7112	18.9134	16.3208	15.1236	17.3546	17.5619	20.4667	22.3410	24.2608	(46)
Water storage loss:													
Store volume												200.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6525	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8924	(55)
Total storage loss	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(56)
If cylinder contains dedicated solar storage	27.6637	24.9865	27.6637	26.7713	27.6637	26.7713	27.6637	27.6637	26.7713	27.6637	26.7713	27.6637	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	217.9347	192.0646	201.6540	180.6915	177.0154	158.0888	151.7504	166.6234	166.3624	187.3705	198.2231	212.6650	(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)

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Output from w/h

	217.9347	192.0646	201.6540	180.6915	177.0154	158.0888	151.7504	166.6234	166.3624	187.3705	198.2231	212.6650 (64)
								Total per year (kWh/year) = Sum(64)m =				2210.4438 (64)

Heat gains from water heating, kWh/month

	96.2712	85.3654	90.8579	83.1199	82.6656	75.6045	74.2649	79.2102	78.3554	86.1086	88.9491	94.5191 (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	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	(66)

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

	27.9636	24.8370	20.1988	15.2918	11.4308	9.6504	10.4276	13.5541	18.1923	23.0993	26.9603	28.7408 (67)

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

	287.7945	290.7809	283.2553	267.2340	247.0101	228.0025	215.3043	212.3179	219.8435	235.8647	256.0886	275.0962 (68)

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

	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536 (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)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289 (71)

Water heating gains (Table 5)

	129.3968	127.0319	122.1208	115.4443	111.1096	105.0062	99.8185	106.4654	108.8270	115.7374	123.5404	127.0417 (72)

Total internal gains

	514.2157	511.7106	494.6357	467.0309	438.6114	411.7199	394.6111	401.3982	415.9237	443.7623	475.6502	499.9396 (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	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Southwest	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(79)
Horizontal	5.7400	26.0000	0.6300	0.7000	1.0000	59.2334	(82)

Solar gains	160.2105	295.0246	454.0477	633.3285	764.0291	779.8929	743.1942	644.1681	516.8171	340.4599	196.1282	134.2577	(83)
Total gains	674.4262	806.7352	948.6834	1100.3594	1202.6405	1191.6128	1137.8053	1045.5662	932.7407	784.2222	671.7784	634.1973	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.9526	72.1522	72.3490	73.2876	73.4660	74.3077	74.3077	74.4657	73.9812	73.4660	73.1061	72.7336	
alpha	5.7968	5.8101	5.8233	5.8858	5.8977	5.9538	5.9538	5.9644	5.9321	5.8977	5.8737	5.8489	
util living area													
	0.9987	0.9959	0.9848	0.9357	0.8019	0.5991	0.4390	0.4965	0.7763	0.9702	0.9966	0.9991	(86)
MIT	19.9701	20.1336	20.3910	20.7049	20.9135	20.9874	20.9983	20.9966	20.9471	20.6493	20.2479	19.9438	(87)
Th 2	20.1125	20.1147	20.1169	20.1273	20.1292	20.1382	20.1382	20.1399	20.1347	20.1292	20.1253	20.1212	(88)
util rest of house													
	0.9982	0.9946	0.9797	0.9152	0.7509	0.5242	0.3541	0.4058	0.7039	0.9566	0.9952	0.9988	(89)
MIT 2	18.7256	18.9658	19.3401	19.7868	20.0484	20.1302	20.1376	20.1385	20.0942	19.7208	19.1413	18.6936	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.1749	19.3875	19.7196	20.1183	20.3608	20.4397	20.4484	20.4483	20.4022	20.0561	19.5408	19.1450	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1749	19.3875	19.7196	20.1183	20.3608	20.4397	20.4484	20.4483	20.4022	20.0561	19.5408	19.1450	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9931	0.9768	0.9150	0.7653	0.5509	0.3848	0.4387	0.7278	0.9552	0.9940	0.9983	(94)
Useful gains	672.7826	801.1416	926.6898	1006.7888	920.3951	656.4670	437.8443	458.6478	678.8097	749.0967	667.7142	633.0984	(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													
	1751.4840	1701.1406	1548.0385	1296.8617	998.7730	665.8138	438.7719	460.5932	721.7157	1090.4885	1441.7617	1740.8364	(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													
	802.5538	604.7993	462.2835	208.8525	58.3131	0.0000	0.0000	0.0000	0.0000	253.9955	557.3142	824.1571	(98)
Space heating												3772.2691	(98)
Space heating per m2											(98) / (4) =	30.9202	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4034.5124	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	802.5538	604.7993	462.2835	208.8525	58.3131	0.0000	0.0000	0.0000	0.0000	253.9955	557.3142	824.1571	(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)													
	858.3464	646.8442	494.4208	223.3717	62.3670	0.0000	0.0000	0.0000	0.0000	271.6530	596.0579	881.4514	(211)

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Water heating requirement
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (215)

Water heating
Water heating requirement
217.9347 192.0646 201.6540 180.6915 177.0154 158.0888 151.7504 166.6234 166.3624 187.3705 198.2231 212.6650 (64)
Efficiency of water heater 79.8000 (216)
(217)m 87.9807 87.6668 86.9586 85.2009 82.2085 79.8000 79.8000 79.8000 79.8000 85.6260 87.4245 88.0776 (217)
Fuel for water heating, kWh/month
247.7075 219.0848 231.8965 212.0771 215.3250 198.1063 190.1634 208.8013 208.4742 218.8244 226.7362 241.4518 (219)
Water heating fuel used 2618.6484 (219)
Annual totals kWh/year
Space heating fuel - main system 4034.5124 (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) 493.8454 (232)
Total delivered energy for all uses 7222.0062 (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	4034.5124	0.2160	871.4547 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2618.6484	0.2160	565.6281 (264)
Space and water heating			1437.0827 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	493.8454	0.5190	256.3057 (268)
Total CO2, kg/m2/year			1732.3135 (272)
Emissions per m2 for space and water heating			11.7794 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1009 (272b)
Emissions per m2 for pumps and fans			0.3191 (272c)
Target Carbon Dioxide Emission Rate (TER) = (11.7794 * 1.00) + 2.1009 + 0.3191, rounded to 2 d.p.			14.2000 (273)

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1419 (8)
Pressure test		Yes
Measured/design q50		5.0000
Infiltration rate		0.3919 (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) =	0.3331 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3331	0.3581	0.3748	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.9800	1.1450	10.2824			(27)
Roof Lights (Uw = 1.20)			5.7400	1.1450	6.5725			(27a)
Party Wall Extension	27.4800		27.4800	0.1100	3.0228			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1100	6.6154			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1100	12.7886			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2818			(33)
Party Wall 1			7.5600	0.0000	0.0000			(32)
Party Floor 1			122.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	32.7900	(36)
Total fabric heat loss (33) + (36) =	72.0718	(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	54.8899	54.5641	54.2448	52.7449	52.4643	51.1580	51.1580	50.9160	51.6611	52.4643	53.0320	53.6255	(38)
Heat transfer coeff	126.9617	126.6359	126.3166	124.8167	124.5361	123.2297	123.2297	122.9878	123.7329	124.5361	125.1038	125.6973	(39)
Average = Sum(39)m / 12 =												124.8153	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0407	1.0380	1.0354	1.0231	1.0208	1.0101	1.0101	1.0081	1.0142	1.0208	1.0254	1.0303	(40)
HLP (average)												1.0231	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.4893	31.0392	32.0297	27.9242	26.7940	23.1212	21.4252	24.5857	24.8793	28.9944	31.6497	34.3695	(65)

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	(66)

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

	27.9636	24.8370	20.1988	15.2918	11.4308	9.6504	10.4276	13.5541	18.1923	23.0993	26.9603	28.7408	(67)

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

	287.7945	290.7809	283.2553	267.2340	247.0101	228.0025	215.3043	212.3179	219.8435	235.8647	256.0886	275.0962	(68)

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

	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	(71)

Water heating gains (Table 5)

	47.7007	46.1893	43.0506	38.7837	36.0134	32.1127	28.7973	33.0453	34.5546	38.9710	43.9579	46.1956	(72)

Total internal gains

	429.5196	427.8680	412.5655	387.3703	360.5152	335.8264	320.5899	324.9781	338.6513	363.9959	393.0677	416.0934	(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	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Southwest	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(79)
Horizontal	5.7400	26.0000	0.6300	0.7000	1.0000	59.2334	(82)

Solar gains	160.2105	295.0246	454.0477	633.3285	764.0291	779.8929	743.1942	644.1681	516.8171	340.4599	196.1282	134.2577	(83)
Total gains	589.7301	722.8926	866.6132	1020.6988	1124.5443	1115.7193	1063.7841	969.1461	855.4683	704.4558	589.1959	550.3512	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.7306	66.9022	67.0714	67.8773	68.0303	68.7515	68.7515	68.8867	68.4719	68.0303	67.7216	67.4018	
alpha	5.4487	5.4601	5.4714	5.5252	5.5354	5.5834	5.5834	5.5924	5.5648	5.5354	5.5148	5.4935	
util living area	0.9993	0.9978	0.9912	0.9597	0.8592	0.6736	0.5038	0.5714	0.8468	0.9840	0.9983	0.9995	(86)
MIT	19.7975	19.9646	20.2353	20.5818	20.8486	20.9707	20.9951	20.9906	20.8979	20.5254	20.0936	19.7711	(87)
Th 2	20.0496	20.0518	20.0540	20.0641	20.0660	20.0749	20.0749	20.0766	20.0715	20.0660	20.0622	20.0582	(88)
util rest of house	0.9991	0.9970	0.9879	0.9449	0.8129	0.5897	0.4010	0.4630	0.7794	0.9759	0.9976	0.9994	(89)
MIT 2	18.9418	19.1103	19.3810	19.7260	19.9653	20.0618	20.0737	20.0739	20.0146	19.6787	19.2479	18.9223	(90)

Living area fraction fLA = Living area / (4) = 0.3611 (91)

MIT	19.2508	19.4188	19.6895	20.0350	20.2843	20.3899	20.4064	20.4049	20.3335	19.9844	19.5532	19.2288	(92)

Temperature adjustment 0.0000

adjusted MIT	19.2508	19.4188	19.6895	20.0350	20.2843	20.3899	20.4064	20.4049	20.3335	19.9844	19.5532	19.2288	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9963	0.9864	0.9443	0.8248	0.6194	0.4384	0.5025	0.8006	0.9750	0.9971	0.9992	(94)
Useful gains	589.0334	720.2038	854.8057	963.8691	927.4812	691.1211	466.3340	486.9856	684.8570	686.8302	587.4746	549.9056	(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	1898.1748	1838.5974	1666.0477	1389.8352	1069.0504	713.4931	469.0570	492.5499	771.2924	1168.6958	1557.9453	1889.0761	(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	974.0012	751.5606	603.5640	306.6956	105.3275	0.0000	0.0000	0.0000	0.0000	358.5080	698.7389	996.3428	(98)

Space heating 4794.7387 (98)

Space heating per m2 (98) / (4) = 39.3011 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1158.3594	911.9000	934.7073	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9034	0.9522	0.9300	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1046.4902	868.2940	869.2427	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1343.6871	1284.6983	1188.8689	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	213.9817	309.8048	237.8018	0.0000	0.0000	0.0000	0.0000	(104)

Space cooling 761.5883 (104)

Cooled fraction fC = cooled area / (4) = 1.0000 (105)

Intermittency factor (Table 10b)

	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	53.4954	77.4512	59.4505	0.0000	0.0000	0.0000	0.0000	(107)

Space cooling 190.3971 (107)

Space cooling per m2 1.5606 (108)

Energy for space heating 39.3011 (99)

Energy for space cooling 1.5606 (108)

Total 40.8618 (109)

Dwelling Fabric Energy Efficiency (DFEE) 40.9 (109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1419	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3919	(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) =	0.3331	(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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3331	0.3581	0.3748	0.3914	(22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opening Type (Uw = 1.40)			8.9800	1.3258	11.9053			(27)
TER Room Window (Uw = 1.70)			5.7400	1.5918	9.1367			(27a)
Party Wall Extension	27.4800		27.4800	0.1800	4.9464			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1800	10.8252			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1300	15.1138			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.9274			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (User defined value 0.050 * total exposed area)		10.9300 (36)
Total fabric heat loss	(33) + (36) =	62.8574 (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	54.8899	54.5641	54.2448	52.7449	52.4643	51.1580	51.1580	50.9160	51.6611	52.4643	53.0320	53.6255	(38)
Heat transfer coeff	117.7473	117.4215	117.1022	115.6023	115.3217	114.0154	114.0154	113.7735	114.5186	115.3217	115.8894	116.4829	(39)
Average = Sum(39)m / 12 =												115.6010	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9651	0.9625	0.9599	0.9476	0.9453	0.9346	0.9346	0.9326	0.9387	0.9453	0.9499	0.9548	(40)
HLP (average)												0.9475	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	35.4893	31.0392	32.0297	27.9242	26.7940	23.1212	21.4252	24.5857	24.8793	28.9944	31.6497	34.3695	(65)

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

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Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	143.5361	(66)

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

	27.9636	24.8370	20.1988	15.2918	11.4308	9.6504	10.4276	13.5541	18.1923	23.0993	26.9603	28.7408	(67)

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

	287.7945	290.7809	283.2553	267.2340	247.0101	228.0025	215.3043	212.3179	219.8435	235.8647	256.0886	275.0962	(68)

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

	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	37.3536	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	(71)

Water heating gains (Table 5)

	47.7007	46.1893	43.0506	38.7837	36.0134	32.1127	28.7973	33.0453	34.5546	38.9710	43.9579	46.1956	(72)

Total internal gains

	429.5196	427.8680	412.5655	387.3703	360.5152	335.8264	320.5899	324.9781	338.6513	363.9959	393.0677	416.0934	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Southwest	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(79)
Horizontal	5.7400	26.0000	0.6300	0.7000	1.0000	59.2334	(82)

Solar gains	160.2105	295.0246	454.0477	633.3285	764.0291	779.8929	743.1942	644.1681	516.8171	340.4599	196.1282	134.2577	(83)
Total gains	589.7301	722.8926	866.6132	1020.6988	1124.5443	1115.7193	1063.7841	969.1461	855.4683	704.4558	589.1959	550.3512	(84)

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7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	71.9526	72.1522	72.3490	73.2876	73.4660	74.3077	74.3077	74.4657	73.9812	73.4660	73.1061	72.7336	
alpha	5.7968	5.8101	5.8233	5.8858	5.8977	5.9538	5.9538	5.9644	5.9321	5.8977	5.8737	5.8489	
util living area	0.9993	0.9977	0.9902	0.9522	0.8340	0.6350	0.4687	0.5336	0.8197	0.9816	0.9983	0.9996	(86)
MIT	19.9030	20.0681	20.3302	20.6588	20.8924	20.9830	20.9976	20.9950	20.9288	20.5939	20.1830	19.8771	(87)
Th 2	20.1125	20.1147	20.1169	20.1273	20.1292	20.1382	20.1382	20.1399	20.1347	20.1292	20.1253	20.1212	(88)
util rest of house	0.9991	0.9969	0.9867	0.9358	0.7861	0.5575	0.3785	0.4372	0.7512	0.9727	0.9976	0.9994	(89)
MIT 2	19.0986	19.2652	19.5272	19.8533	20.0588	20.1307	20.1376	20.1385	20.0959	19.7984	19.3889	19.0799	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.3891	19.5551	19.8172	20.1442	20.3598	20.4384	20.4481	20.4478	20.3966	20.0856	19.6756	19.3678	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3891	19.5551	19.8172	20.1442	20.3598	20.4384	20.4481	20.4478	20.3966	20.0856	19.6756	19.3678	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9989	0.9962	0.9852	0.9362	0.7998	0.5852	0.4112	0.4722	0.7737	0.9721	0.9971	0.9992	(94)
Useful gains	589.0706	720.1689	853.8007	955.5417	899.3806	652.9137	437.4189	457.6541	661.8700	684.7990	587.4742	549.9382	(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	1776.6984	1720.8209	1559.4704	1299.8523	998.6598	665.6685	438.7435	460.5277	721.0813	1093.8982	1457.3792	1766.7865	(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	883.5951	672.4382	525.0183	247.9036	73.8637	0.0000	0.0000	0.0000	0.0000	304.3698	626.3316	905.3352	(98)
Space heating												4238.8554	(98)
Space heating per m2											(98) / (4) =	34.7447	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1071.7445	843.7137	864.6783	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9336	0.9703	0.9542	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1000.5281	818.6762	825.0654	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1343.6871	1284.6983	1188.8689	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	247.0744	346.7205	270.6698	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												864.4646	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	61.7686	86.6801	67.6674	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												216.1162	(107)
Space cooling per m2												1.7714	(108)
Energy for space heating												34.7447	(99)
Energy for space cooling												1.7714	(108)
Total												36.5162	(109)
Target Fabric Energy Efficiency (TFEE)												42.0	(109)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1065	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3565	(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) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.3000	3.2000	3.4000	3.4000	3.9000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8250	0.8000	0.8500	0.8500	0.9750	(22a)
Adj infilt rate	0.3181	0.3030	0.3030	0.2803	0.2803	0.2500	0.2575	0.2500	0.2424	0.2575	0.2575	0.2954	(22b)
Effective ac	0.5506	0.5459	0.5459	0.5393	0.5393	0.5312	0.5332	0.5312	0.5294	0.5332	0.5332	0.5436	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.9800	1.1450	10.2824			(27)
Roof Lights (Uw = 1.20)			5.7400	1.1450	6.5725			(27a)
Party Wall Extension	27.4800		27.4800	0.1100	3.0228			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1100	6.6154			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1100	12.7886			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2818			(33)
Party Wall 1			7.5600	0.0000	0.0000			(32)
Party Floor 1			122.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	32.7900	(36)
Total fabric heat loss (33) + (36) =	72.0718	(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	51.2065	50.7690	50.7690	50.1527	50.1527	49.4057	49.5844	49.4057	49.2323	49.5844	49.5844	50.5582	(38)
Heat transfer coeff	123.2783	122.8407	122.8407	122.2244	122.2244	121.4774	121.6562	121.4774	121.3040	121.6562	121.6562	122.6300	(39)
Average = Sum(39)m / 12 =												122.1055	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0105	1.0069	1.0069	1.0018	1.0018	0.9957	0.9972	0.9957	0.9943	0.9972	0.9972	1.0052	(40)
HLP (average)												1.0009	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0513	21.9100	22.6092	19.7112	18.9134	16.3208	15.1236	17.3546	17.5619	20.4667	22.3410	24.2608	(46)
Water storage loss:													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.9372	(55)
Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

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Total heat required for water heating calculated for each month

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (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

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)
								Total per year (kWh/year) = Sum(64)m =				2226.7983 (64)

RHI water heating demand 2227 (64)

Heat gains from water heating, kWh/month

	97.3824	86.3691	91.9691	84.1952	83.7768	76.6798	75.3761	80.3214	79.4308	87.2198	90.0245	95.6303 (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	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	(66)

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

	69.9089	62.0925	50.4970	38.2295	28.5770	24.1259	26.0689	33.8853	45.4808	57.7483	67.4008	71.8519	(67)

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

	429.5440	434.0014	422.7690	398.8568	368.6719	340.3023	321.3497	316.8923	328.1246	352.0369	382.2218	410.5914	(68)

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

	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	(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)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	(71)

Water heating gains (Table 5)

	130.8904	128.5254	123.6144	116.9378	112.6032	106.4998	101.3120	107.9589	110.3206	117.2310	125.0340	128.5353	(72)

Total internal gains

	745.8528	740.1288	712.3899	669.5336	625.3615	586.4374	564.2400	574.2460	599.4355	642.5257	690.1661	726.4881	(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	
Southeast	6.9800	39.0225	0.6300	0.7000	0.7700	83.2419	(77)
Southwest	2.0000	39.0225	0.6300	0.7000	0.7700	23.8515	(79)
Horizontal	5.7400	29.0000	0.6300	0.7000	1.0000	66.0680	(82)

Solar gains	173.1614	286.7321	443.9117	640.3616	752.4707	820.2057	779.5685	696.6695	555.2355	361.6952	219.0085	148.5935	(83)
Total gains	919.0142	1026.8609	1156.3016	1309.8952	1377.8322	1406.6431	1343.8086	1270.9156	1154.6710	1004.2209	909.1747	875.0816	(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	68.7244	68.9692	68.9692	69.3169	69.3169	69.7432	69.6407	69.7432	69.8429	69.6407	69.6407	69.0877	
alpha	5.5816	5.5979	5.5979	5.6211	5.6211	5.6495	5.6427	5.6495	5.6562	5.6427	5.6427	5.6058	
util living area	0.9906	0.9818	0.9455	0.8316	0.6191	0.3705	0.2082	0.2389	0.5284	0.8663	0.9755	0.9925	(86)
MIT	20.2293	20.3599	20.6213	20.8658	20.9787	20.9990	21.0000	20.9999	20.9932	20.8604	20.5174	20.2033	(87)
Th 2	20.0746	20.0776	20.0776	20.0818	20.0818	20.0869	20.0857	20.0869	20.0881	20.0857	20.0857	20.0790	(88)
util rest of house	0.9875	0.9759	0.9280	0.7873	0.5478	0.2923	0.1254	0.1517	0.4376	0.8175	0.9660	0.9900	(89)
MIT 2	19.0744	19.2641	19.6308	19.9480	20.0668	20.0866	20.0857	20.0869	20.0849	19.9534	19.4978	19.0403	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.4914	19.6598	19.9884	20.2794	20.3960	20.4160	20.4158	20.4166	20.4129	20.2809	19.8659	19.4602	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3414	19.5098	19.8384	20.1294	20.2460	20.2660	20.2658	20.2666	20.2629	20.1309	19.7159	19.3102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9711	0.9226	0.7898	0.5610	0.3077	0.1418	0.1688	0.4553	0.8203	0.9610	0.9871	(94)
Useful gains	904.4468	997.2219	1066.8491	1034.5168	772.9186	432.8062	190.4867	214.5905	525.7383	823.7346	873.7407	863.7688	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.7000	18.7000	18.5000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	1681.6894	1634.9829	1429.6731	1152.5034	787.8616	433.1927	190.4894	214.5982	529.2330	940.5137	1340.1582	1669.0181	(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	578.2685	428.5754	269.9411	84.9503	11.1176	0.0000	0.0000	0.0000	0.0000	86.8837	335.8206	599.1054	(98)

Space heating 2394.6626 (98)

RHI space heating demand 2395 (98)

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	281.8200	(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) =	0.1065	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3565	(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) =	0.3030	(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	0.3863	0.3787	0.3712	0.3333	0.3257	0.2878	0.2878	0.2803	0.3030	0.3257	0.3409	0.3560	(22b)
Effective ac	0.5746	0.5717	0.5689	0.5555	0.5530	0.5414	0.5414	0.5393	0.5459	0.5530	0.5581	0.5634	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.9800	1.1450	10.2824			(27)
Roof Lights (Uw = 1.20)			5.7400	1.1450	6.5725			(27a)
Party Wall Extension	27.4800		27.4800	0.1100	3.0228			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1100	6.6154			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1100	12.7886			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2818			(33)
Party Wall 1			7.5600	0.0000	0.0000			(32)
Party Floor 1			122.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	32.7900	(36)
Total fabric heat loss	(33) + (36) = 72.0718	(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	53.4396	53.1701	52.9060	51.6654	51.4333	50.3528	50.3528	50.1527	50.7690	51.4333	51.9028	52.3937	(38)
Heat transfer coeff	125.5113	125.2419	124.9777	123.7372	123.5050	122.4245	122.4245	122.2244	122.8407	123.5050	123.9746	124.4655	(39)
Average = Sum(39)m / 12 =												123.7360	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0288	1.0266	1.0244	1.0142	1.0123	1.0035	1.0035	1.0018	1.0069	1.0123	1.0162	1.0202	(40)
HLP (average)												1.0142	(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	2.8707 (42)
Average daily hot water use (litres/day)	102.3796 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0513	21.9100	22.6092	19.7112	18.9134	16.3208	15.1236	17.3546	17.5619	20.4667	22.3410	24.2608	(46)

Water storage loss:	
Store volume	200.0000 (47)
b) If manufacturer declared loss factor is not known :	
Hot water storage loss factor from Table 2 (kWh/litre/day)	0.0103 (51)
Volume factor from Table 2a	0.8434 (52)
Temperature factor from Table 2b	0.5400 (53)
Enter (49) or (54) in (55)	0.9372 (55)

Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

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Total heat required for water heating calculated for each month

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (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

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)
								Total per year (kWh/year) = Sum(64)m =				2226.7983 (64)

Heat gains from water heating, kWh/month

	97.3824	86.3691	91.9691	84.1952	83.7768	76.6798	75.3761	80.3214	79.4308	87.2198	90.0245	95.6303 (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	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	(66)

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

	69.9089	62.0925	50.4970	38.2295	28.5770	24.1259	26.0689	33.8853	45.4808	57.7483	67.4008	71.8519	(67)

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

	429.5440	434.0014	422.7690	398.8568	368.6719	340.3023	321.3497	316.8923	328.1246	352.0369	382.2218	410.5914	(68)

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

	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	(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)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	(71)

Water heating gains (Table 5)

	130.8904	128.5254	123.6144	116.9378	112.6032	106.4998	101.3120	107.9589	110.3206	117.2310	125.0340	128.5353	(72)

Total internal gains

	745.8528	740.1288	712.3899	669.5336	625.3615	586.4374	564.2400	574.2460	599.4355	642.5257	690.1661	726.4881	(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	
Southeast	6.9800	36.7938	0.6300	0.7000	0.7700	78.4878	(77)
Southwest	2.0000	36.7938	0.6300	0.7000	0.7700	22.4893	(79)
Horizontal	5.7400	26.0000	0.6300	0.7000	1.0000	59.2334	(82)

Solar gains	160.2105	295.0246	454.0477	633.3285	764.0291	779.8929	743.1942	644.1681	516.8171	340.4599	196.1282	134.2577	(83)
Total gains	906.0633	1035.1534	1166.4376	1302.8620	1389.3906	1366.3303	1307.4342	1218.4141	1116.2525	982.9855	886.2943	860.7459	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	67.5017	67.6469	67.7898	68.4695	68.5982	69.2036	69.2036	69.3169	68.9692	68.5982	68.3384	68.0688	
alpha	5.5001	5.5098	5.5193	5.5646	5.5732	5.6136	5.6136	5.6211	5.5979	5.5732	5.5559	5.5379	
util living area	0.9943	0.9875	0.9668	0.9000	0.7572	0.5624	0.4103	0.4582	0.7126	0.9361	0.9878	0.9957	(86)
MIT	20.0592	20.2171	20.4608	20.7437	20.9238	20.9880	20.9983	20.9969	20.9588	20.7124	20.3311	20.0271	(87)
Th 2	20.0594	20.0612	20.0630	20.0715	20.0731	20.0804	20.0804	20.0818	20.0776	20.0731	20.0699	20.0665	(88)
util rest of house	0.9926	0.9836	0.9566	0.8716	0.7014	0.4864	0.3255	0.3685	0.6348	0.9112	0.9833	0.9943	(89)
MIT 2	18.8158	19.0455	19.3946	19.7862	20.0042	20.0731	20.0798	20.0806	20.0478	19.7558	19.2188	18.7743	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.2647	19.4685	19.7796	20.1319	20.3362	20.4034	20.4114	20.4114	20.3767	20.1012	19.6204	19.2266	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.1147	19.3185	19.6296	19.9819	20.1862	20.2534	20.2614	20.2614	20.2267	19.9512	19.4704	19.0766	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9796	0.9507	0.8685	0.7087	0.5010	0.3423	0.3862	0.6481	0.9072	0.9794	0.9923	(94)
Useful gains	897.0709	1013.9977	1108.9505	1131.5133	984.6371	684.5303	447.5260	470.5590	723.4619	891.7776	868.0129	854.0792	(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	1859.4184	1805.8017	1640.9023	1371.2469	1048.0921	692.1191	448.2501	471.9606	752.6129	1154.9223	1533.6120	1851.6288	(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	715.9865	532.0923	395.7721	172.6082	47.2105	0.0000	0.0000	0.0000	0.0000	195.7797	479.2313	742.1769	(98)
Space heating												3280.8575	(98)
Space heating per m2											(98) / (4) =	26.8923	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	3531.6011 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	715.9865	532.0923	395.7721	172.6082	47.2105	0.0000	0.0000	0.0000	0.0000	195.7797	479.2313	742.1769	(98)

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Space heating efficiency (main heating system 1)

92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)

Space heating fuel (main heating system)

770.7067	572.7581	426.0195	185.8000	50.8186	0.0000	0.0000	0.0000	0.0000	210.7424	515.8572	798.8987 (211)

Water heating requirement

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)

Efficiency of water heater

(217)m	90.3166	89.9751	89.2102	87.4261	84.7275	82.8000	82.8000	82.8000	82.8000	87.6517	89.6837	90.4307 (217)

Fuel for water heating, kWh/month

242.8387	214.8584	227.6006	208.2167	210.5625	192.5519	184.9509	202.9136	202.5442	215.3518	222.5234	236.7050 (219)

Water heating fuel used 2561.6178 (219)

Annual totals kWh/year

Space heating fuel - main system 3531.6011 (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) 493.8454 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

Total delivered energy for all uses 6662.0643 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3531.6011	3.4800	122.8997	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2561.6178	3.4800	89.1443	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	493.8454	13.1900	65.1382	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-780.0000	13.1900	-102.8820	(252)
Total energy cost			304.1927	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.7650	(257)
SAP value		89.3278	
SAP rating (Section 12)		89	(258)
SAP band		B	

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	3531.6011	0.2160	762.8258	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2561.6178	0.2160	553.3094	(264)
Space and water heating			1316.1353	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	493.8454	0.5190	256.3057	(268)
Energy saving/generation technologies				
PV Unit	-780.0000	0.5190	-404.8200	(269)
Total kg/year			1206.5460	(272)
CO2 emissions per m2			9.8900	(273)
EI value			90.3187	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9290 = 3.746, stars = 5
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9290 = 0.2325, stars = 4
Water heating energy efficiency	3.48 / 0.8672 = 4.013, stars = 4
Water heating environmental impact	0.216 / 0.8672 = 0.2491, stars = 4

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	122.0000 (1b)	x	2.3100 (2b)	=	281.8200 (1b) - (3b)	
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.0000					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	281.8200	(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) =	0.1065	(8)
Pressure test		Yes	
Measured/design q50		5.0000	
Infiltration rate		0.3565	(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) =	0.3030	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.3000	3.2000	3.4000	3.4000	3.9000	(22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8250	0.8000	0.8500	0.8500	0.9750	(22a)
Adj infilt rate	0.3181	0.3030	0.3030	0.2803	0.2803	0.2500	0.2575	0.2500	0.2424	0.2575	0.2575	0.2954	(22b)
Effective ac	0.5506	0.5459	0.5459	0.5393	0.5393	0.5312	0.5332	0.5312	0.5294	0.5332	0.5332	0.5436	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Windows (Uw = 1.20)			8.9800	1.1450	10.2824			(27)
Roof Lights (Uw = 1.20)			5.7400	1.1450	6.5725			(27a)
Party Wall Extension	27.4800		27.4800	0.1100	3.0228			(29a)
New Slate Mansard	69.1200	8.9800	60.1400	0.1100	6.6154			(29a)
External Roof 1	122.0000	5.7400	116.2600	0.1100	12.7886			(30)
Total net area of external elements Aum(A, m2)			218.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.2818			(33)
Party Wall 1			7.5600	0.0000	0.0000			(32)
Party Floor 1			122.0000					(32d)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	32.7900	(36)
Total fabric heat loss (33) + (36) =	72.0718	(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	51.2065	50.7690	50.7690	50.1527	50.1527	49.4057	49.5844	49.4057	49.2323	49.5844	49.5844	50.5582	(38)
Heat transfer coeff	123.2783	122.8407	122.8407	122.2244	122.2244	121.4774	121.6562	121.4774	121.3040	121.6562	121.6562	122.6300	(39)
Average = Sum(39)m / 12 =												122.1055	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0105	1.0069	1.0069	1.0018	1.0018	0.9957	0.9972	0.9957	0.9943	0.9972	0.9972	1.0052	(40)
HLP (average)												1.0009	(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	2.8707	(42)
Average daily hot water use (litres/day)	102.3796	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6176	108.5224	104.4272	100.3320	96.2369	92.1417	92.1417	96.2369	100.3320	104.4272	108.5224	112.6176	(44)
Energy conte	167.0086	146.0668	150.7279	131.4082	126.0893	108.8055	100.8243	115.6973	117.0791	136.4444	148.9398	161.7390	(45)
Energy content (annual)										Total = Sum(45)m =		1610.8303	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0513	21.9100	22.6092	19.7112	18.9134	16.3208	15.1236	17.3546	17.5619	20.4667	22.3410	24.2608	(46)
Water storage loss:													
Store volume												200.0000	(47)
b) If manufacturer declared loss factor is not known :													
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103	(51)
Volume factor from Table 2a												0.8434	(52)
Temperature factor from Table 2b												0.5400	(53)
Enter (49) or (54) in (55)												0.9372	(55)
Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)

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Total heat required for water heating calculated for each month

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (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

	219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)
								Total per year (kWh/year) = Sum(64)m =				2226.7983 (64)

Heat gains from water heating, kWh/month

	97.3824	86.3691	91.9691	84.1952	83.7768	76.6798	75.3761	80.3214	79.4308	87.2198	90.0245	95.6303 (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	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	172.2433	(66)

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

	69.9089	62.0925	50.4970	38.2295	28.5770	24.1259	26.0689	33.8853	45.4808	57.7483	67.4008	71.8519	(67)

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

	429.5440	434.0014	422.7690	398.8568	368.6719	340.3023	321.3497	316.8923	328.1246	352.0369	382.2218	410.5914	(68)

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

	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	55.0951	(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)

	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	-114.8289	(71)

Water heating gains (Table 5)

	130.8904	128.5254	123.6144	116.9378	112.6032	106.4998	101.3120	107.9589	110.3206	117.2310	125.0340	128.5353	(72)

Total internal gains

	745.8528	740.1288	712.3899	669.5336	625.3615	586.4374	564.2400	574.2460	599.4355	642.5257	690.1661	726.4881	(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	
Southeast	6.9800	39.0225	0.6300	0.7000	0.7700	83.2419	(77)
Southwest	2.0000	39.0225	0.6300	0.7000	0.7700	23.8515	(79)
Horizontal	5.7400	29.0000	0.6300	0.7000	1.0000	66.0680	(82)

Solar gains	173.1614	286.7321	443.9117	640.3616	752.4707	820.2057	779.5685	696.6695	555.2355	361.6952	219.0085	148.5935	(83)
Total gains	919.0142	1026.8609	1156.3016	1309.8952	1377.8322	1406.6431	1343.8086	1270.9156	1154.6710	1004.2209	909.1747	875.0816	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.7244	68.9692	68.9692	69.3169	69.3169	69.7432	69.6407	69.7432	69.8429	69.6407	69.6407	69.0877	
alpha	5.5816	5.5979	5.5979	5.6211	5.6211	5.6495	5.6427	5.6495	5.6562	5.6427	5.6427	5.6058	
util living area	0.9906	0.9818	0.9455	0.8316	0.6191	0.3705	0.2082	0.2389	0.5284	0.8663	0.9755	0.9925	(86)
MIT	20.2293	20.3599	20.6213	20.8658	20.9787	20.9990	21.0000	20.9999	20.9932	20.8604	20.5174	20.2033	(87)
Th 2	20.0746	20.0776	20.0776	20.0818	20.0818	20.0869	20.0857	20.0869	20.0881	20.0857	20.0857	20.0790	(88)
util rest of house	0.9875	0.9759	0.9280	0.7873	0.5478	0.2923	0.1254	0.1517	0.4376	0.8175	0.9660	0.9900	(89)
MIT 2	19.0744	19.2641	19.6308	19.9480	20.0668	20.0866	20.0857	20.0869	20.0849	19.9534	19.4978	19.0403	(90)
Living area fraction									fLA = Living area / (4) =			0.3611	(91)
MIT	19.4914	19.6598	19.9884	20.2794	20.3960	20.4160	20.4158	20.4166	20.4129	20.2809	19.8659	19.4602	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3414	19.5098	19.8384	20.1294	20.2460	20.2660	20.2658	20.2666	20.2629	20.1309	19.7159	19.3102	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9841	0.9711	0.9226	0.7898	0.5610	0.3077	0.1418	0.1688	0.4553	0.8203	0.9610	0.9871	(94)
Useful gains	904.4468	997.2219	1066.8491	1034.5168	772.9186	432.8062	190.4867	214.5905	525.7383	823.7346	873.7407	863.7688	(95)
Ext temp.	5.7000	6.2000	8.2000	10.7000	13.8000	16.7000	18.7000	18.5000	15.9000	12.4000	8.7000	5.7000	(96)
Heat loss rate W	1681.6894	1634.9829	1429.6731	1152.5034	787.8616	433.1927	190.4894	214.5982	529.2330	940.5137	1340.1582	1669.0181	(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	578.2685	428.5754	269.9411	84.9503	11.1176	0.0000	0.0000	0.0000	0.0000	86.8837	335.8206	599.1054	(98)
Space heating												2394.6626	(98)
Space heating per m2											(98) / (4) =	19.6284	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	92.9000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	2577.6778 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.2685	428.5754	269.9411	84.9503	11.1176	0.0000	0.0000	0.0000	0.0000	86.8837	335.8206	599.1054	(98)

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Space heating efficiency (main heating system 1)

92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)

Space heating fuel (main heating system)

622.4634	461.3298	290.5717	91.4428	11.9673	0.0000	0.0000	0.0000	0.0000	93.5239	361.4861	644.8928 (211)

Water heating requirement

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)

Water heating

Water heating requirement

219.3237	193.3192	203.0430	182.0357	178.4044	159.4330	153.1394	168.0124	167.7066	188.7595	199.5673	214.0540 (64)

Efficiency of water heater 82.8000 (216)

(217)m 89.8850	89.5061	88.2774	85.7669	83.3315	82.8000	82.8000	82.8000	82.8000	85.7381	88.8597	90.0098 (217)

Fuel for water heating, kWh/month

244.0047	215.9844	230.0055	212.2447	214.0901	192.5519	184.9509	202.9136	202.5442	220.1582	224.5870	237.8119 (219)

Water heating fuel used 2581.8474 (219)

Annual totals kWh/year

Space heating fuel - main system 2577.6778 (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) 493.8454 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

Total delivered energy for all uses 5728.3705 (238)

10a. Fuel costs - using BEDF prices (384)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2577.6778	4.2500	109.5513 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2581.8474	4.2500	109.7285 (247)
Pumps and fans for heating	75.0000	15.0600	11.2950 (249)
Energy for lighting	493.8454	15.0600	74.3731 (250)
Additional standing charges			101.0000 (251)
Energy saving/generation technologies			
PV Unit	-780.0000	15.0600	-117.4680 (252)
Total energy cost			288.4799 (255)

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	2577.6778	0.2160	556.7784 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2581.8474	0.2160	557.6790 (264)
Space and water heating			1114.4574 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	493.8454	0.5190	256.3057 (268)
Energy saving/generation technologies			
PV Unit	-780.0000	0.5190	-404.8200 (269)
Total kg/year			1004.8682 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2577.6778	1.2200	3144.7669 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2581.8474	1.2200	3149.8538 (264)
Space and water heating			6294.6206 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	493.8454	3.0700	1516.1053 (268)
Energy saving/generation technologies			
PV Unit	-780.0000	3.0700	-2394.6000 (269)
Primary energy kWh/year			5646.3759 (272)
Primary energy kWh/m2/year			46.2818 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89

Current environmental impact rating: B 90

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Not applicable

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O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Not applicable
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
(none)			

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
(none)				
Total Savings	£0	0.00 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 384 TEST (28 Oct 2015)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£86	£86	£0
Mains gas	£320	£320	£0
Space heating	£222	£222	£0
Water heating	£110	£110	£0
Lighting	£74	£74	£0
Generated (PV)	-£117	-£117	£0
Total cost of fuels	£289	£289	£0
Total cost of uses	£289	£289	£0
Delivered energy	47 kWh/m²	47 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.0 tonnes	1.0 tonnes	0.0 tonnes
CO2 emissions per m²	8 kg/m²	8 kg/m²	0 kg/m²
Primary energy	46 kWh/m²	46 kWh/m²	0 kWh/m²

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

No improvements selected / applicable

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached Flat
Number of storeys	1
Cross ventilation possible	No
SAP Region	Thames Valley
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	372.00 (P1)
Transmission heat loss coefficient	72.07 (37)
Summer heat loss coefficient	444.07 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
South East	0.000	1.000	None
South West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
Horizontal	1.000	1.00	1.000	1.000 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	6.9800	119.9223	0.6300	0.7000	0.9000	299.0055
South West	2.0000	119.9223	0.6300	0.7000	0.9000	85.6749
Horizontal	5.7400	203.0000	0.6300	0.7000	1.0000	462.4758
total:						847.1562

	Jun	Jul	Aug	
Solar gains	898	847	753	(P3)
Internal gains	583	561	571	
Total summer gains	1482	1408	1324	(P5)
Summer gain/loss ratio	3.34	3.17	2.98	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	19.59	21.32	21.03	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight

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