



PORTMAN WAY- READING, BERKSHIRE



ENERGY STATEMENT

13th August 2018

SEC/cs/DC/ES/3560/-



Southern Energy
Consultants
Energy & Sustainability Solutions

About Southern Energy Consultants Ltd

Southern Energy Consultants Ltd are a construction consultancy specialising in sustainability, energy conservation, the application of renewable technologies and statutory utilities infrastructure design and management. As a consultancy we do not sell or have financial interest in any products so are able to take an objective view of developments to assist developers with incorporating cost effective and practical solutions.

Our services include Planning Energy Statements, energy calculations for Building Regulation compliance, Code for Sustainable Homes assessments and utilities design and management. Our team of consultants include registered SAP, SBEM and Code for Sustainable Homes assessors, Planning Specialists, Renewable Energy Specialists, CAD Specialist, Utilities Specialists and Civil Engineers.

Within SEC Ltd we have over 25 years experience working with and for National Developers, Construction and Design and Build Contractors we apply our expertise not only to assist with developers understanding of new energy and sustainability obligations but also in a way that ensures that the needs and responsibilities of all stakeholders are wholly respected.

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13th August 2018

Report type:

Planning Condition Discharge: Supporting Document

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1.0 Introduction

- 1.1 This Energy Statement has been commissioned by Bellway Homes Ltd (the Client) and carried out by Southern Energy Consultants as part of a comprehensive analysis of available opportunities to reduce carbon dioxide emissions and energy consumption at their development on the Battle Hospital Site, Portman Road, Reading.
- 1.2 The site falls under the Reading Borough Council jurisdiction, with the client having secured full planning permission (Ref: 180319/FUL) for the development of 211 dwellings with associated access, cycle path provision, parking, landscaping and open space provision, following demolition of existing buildings.
- 1.3 This Statement provides a response to Planning Condition 22 of the Decision Notice for the site, dated 18th July 2018, which required the provision of:
- “SU1 evidence (Design Stage Standard Assessment Procedure) that 50% of the dwellings will achieve a minimum of a 19% improvement in the dwelling emission rate over the target emission rate, as defined in The Building Regulations for England Approved Document L1A: Conservation of Fuel and Power in New Dwellings (2013 edition).”*
- 1.4 Linked to these stipulations is Condition 23, which requires the same performance standards to be met at the as-built stage. This Statement only addresses the as-designed performance standards in relation to Condition 22.
- 1.5 Condition 22 is broadly underpinned by Policy CS1 (Sustainable Construction and Design) of Reading Borough Council’s Core Strategy (revised adopted version, January 2015), although it should be noted that some of its targets are out of date. Policy CS1 requires proposals for new buildings and site layouts to use energy, water, minerals and other natural resources appropriately, efficiently and with care, and to take account of the effects of climate change. With regards to targets, Policy CS1 requires new developments to meet the Eco-Homes ‘Very Good’ standard for housing, with a 20% reduction in carbon dioxide emissions secured across the development from energy efficiency measures and/or the installation of renewable energy technologies. However, these standards relate to the original publication of Reading’s Core Strategy in 2008, having not been updated since,

and greater clarity on planning policy objectives in relation to Policy CS1 is outlined in Reading's Sustainable Design and Construction Supplementary Planning Document (adopted July 2011). This document states that target standards include 50% of dwellings to achieve a minimum of a Level 4 rating under the Code for Sustainable Homes (which superseded Eco-Homes). In the period since 2011, the Code for Sustainable Homes (CSH) has also been abolished, however, local planning authorities remain permitted to set energy performance standards up to the mandatory energy performance requirements of the lapsed CSH scheme. This necessitates a 19% reduction in carbon dioxide emissions compared to the standard set by Part L1a of Building Regulations (2013 version). In the case of Reading Borough Council, and as reflected in Condition 22, a minimum of 50% of site dwellings are required to deliver the 19% reduction target.

- 1.6 In the light of the requirements set by Planning Condition 22 and its underpinning local policies, this Statement will (a) first set out an array of best practice energy efficiency proposals, sufficient for the 211 proposed dwellings to meet and better the Part L1a (2013) compliant baseline standard for carbon dioxide emissions, and (b) conduct a brief feasibility study concerning the most suitable renewable energy technology for the development, before demonstrating through as-designed SAP calculations that at least 50% of dwellings will deliver a 19% reduction in carbon dioxide emissions. Section 2 of this Statement responds to part (a), with Section 3 focused on (b). Examples of detailed SAP calculations for common dwelling types are provided in the Appendix to this Statement.

2.0 Emissions Baseline and Energy Efficiency Proposals

Building Regulations (2013) Baseline

- 2.1 In order that an energy assessment can be conducted, a Building Regulation (2013) baseline for carbon dioxide emissions must first be calculated for the 211 dwellings. The predicted emissions for the dwellings have been calculated by an accredited energy assessor using SAP (2012) methodology and Elmhurst approved software. This baseline will then be used as a standard to demonstrate the reductions in emissions that will result from best practice energy efficiency measures.
- 2.2 The Building Regulations (2013) baseline for the development identifies predicted annual carbon dioxide emissions for the development of **260,457 kgCO₂/year**. Table 1 sets out the emissions particular to each dwelling type (average results) and block.

Table 1: Baseline Carbon Dioxide Emissions (kgCO₂/year)

Dwelling Type	Dwelling Type Carbon Dioxide Emissions (kgCO ₂ /year)	Number of dwellings	Total Carbon Dioxide Emissions (kgCO ₂ /year)
Block 1			
1BA	1,004	29	29,116
2BA	1,180	70	82,600
3BA	1,267	2	2,534
Block 2			
1BA	1,012	6	6,072
2BA	1,191	9	10,719
3BA	1,261	2	2,522
Block 3			
1BA	1,007	4	4,028
2BA	1,185	11	13,035
3BA	1,263	3	3,789
Block 4			
1BA	1,018	4	4,072
2BA	1,198	9	10,782
3BA	1,278	4	5,112
Block 5			
1BA	1,004	2	2,008
2BA	1,181	6	7,086
3BA	1,265	3	3,795
Houses			
Two bed house	1,545	1	1,545
Three bed houses and townhouses	1,645	46	75,670
TOTAL		211	260,457

2.3 In accordance with the Client's intentions set out in the Introduction, this Statement will now continue by detailing the range of best practice energy efficiency measures to deliver a betterment of the baseline scenario.

Best Practice Energy Efficiency Measures

- 2.4 As a first energy efficiency measure, the proposed dwellings will incorporate sufficient insulation in the building envelope (walls, roofs, floors and glazing) to achieve average U-values considerably better than the limiting standards demanded by Part L1a of 2013 Building Regulations. Table 2 below illustrates the proposed U-values and the limiting area-weighted values set by Part L1a of 2013 Building Regulations.

Table 2: Insulation Enhancement Proposals

Thermal Element	Maximum Area-Weighted U-value (W/m²K) Allowable Under 2013 Building Regulations	Proposed U-value (W/m²K) Required to Meet 2013 Building Regulations Baseline	% Improvement on 2013 Allowable U-Value Standard
Main external walls (houses)	0.30	0.20	33.33
Main external walls (block 1, lower floors)	0.30	0.21	30.00
Main external walls (block 1, upper floors)	0.30	0.20	33.33
Concrete frame (block 1)	0.30	0.16	46.67
Main external walls (blocks 2 to 5)	0.30	0.20	33.33
Party walls	0.20	0.00	-
Roof (joists)	0.20	0.11	45.00
Roof (flat)	0.20	0.15	25.00
Ground floor	0.25	0.11	44.00
Windows	2.00	1.30	30.00

- 2.5 The Client intends to meet the U-value performance standards detailed in Table 2 through the following construction specification for the main thermal elements, as set out in Table 3:

Table 3: Fabric Enhancement Construction Specification

Construction Element	Delivered U-Value	Insulation Specification
Main external walls (houses)	0.20	External finish, 150mm cavity to be fully filled with Knauf Supafil 34 insulation, aircrete blocks (thermal conductivity of 0.19 W/m ² K), plasterboard on dabs.
Main external walls (block 1, lower floors)	0.21	External finish, 150mm cavity to be fully filled with Knauf Supafil 34 insulation, medium density blocks (thermal conductivity of 0.45 W/m ² K), plasterboard on dabs.
Main external walls (block 1, upper floors)	0.20	External finish, 150mm cavity to be fully filled with Knauf Supafil 34 insulation, aircrete blocks (thermal conductivity of 0.19 W/m ² K), plasterboard on dabs.
Concrete frame (block 1)	0.16	Concrete frame in-filled with Metsec steel frame construction.
Main external walls (blocks 2 to 5)	0.20	External finish, 150mm cavity to be fully filled with Knauf Supafil 34 insulation, aircrete blocks (thermal conductivity of 0.19 W/m ² K), plasterboard on dabs.
Party walls	0.00	Fully filled and sealed.
Roof (joists)	0.11	One layer of 100mm mineral wool insulation (thermal conductivity of 0.044 W/m ² K) laid between ceiling joists and one layer of 300mm mineral wool insulation (thermal conductivity of 0.044 W/m ² K) laid over to provide a total thickness of 400mm.
Roof (flat)	0.15	PCC deck with 150mm TR70 insulation (thermal conductivity of 0.022 W/m ² K).
Ground floor	0.11	Beam and block construction (175mm beam) to include 150mm TF70 insulation (thermal conductivity maximum of 0.022 W/m ² K) with screed topping.
Windows	1.30	PVCu double-glazed windows with low 'e' hard coat glazing to specialist BFRC design and specification.

- 2.6 The performance standards and fabric measures detailed in Tables 2 and 3 will result in a reduced space heating requirement for the dwellings. The dwellings will also benefit from advanced heating controls through the installation of optimum start thermostats and Time and Temperature Zone Controls. As such, it will be possible for future occupants to minimise the emissions associated with the heating operation of their home.
- 2.7 The specified boiler for all dwellings will be an Ideal Logic Combi ESP1 35, which has a SEDBUK (2009) energy efficiency of 89%.
- 2.8 Air tightness standards will be improved by the Client adopting a mixture of Aircrete Product Association (APA) and Accredited Construction Details (ACD) for non-repeating thermal bridges. These details incorporate an improvement over Building Regulations (2013) requirements by reducing air leakage loss and convective bypass of insulation. The Client will reduce each dwelling's design air permeability from $10\text{m}^3/\text{hm}^2$ to $5\text{m}^3/\text{hm}^2$ to further reduce space heating requirements.
- 2.9 It is not proposed to provide any mechanical cooling to the proposed dwellings. Instead it is the intention of the Client to reduce the need for active cooling as far as possible. This will be achieved through the specification of mainly non-mechanical measures such as good thermal insulation and an air tight build. Ventilation to the dwellings will be facilitated via the installation of highly efficient Vent Axia decentralised extract fans. In addition, the development will adopt a range of passive ventilation measures. Openable windows will be installed as a necessary fixture to facilitate natural ventilation. These will help facilitate cross-ventilation, convective-ventilation and night purging.
- 2.10 All of the internal lighting throughout the development will be of the dedicated low energy type. External lighting will also be low energy and some will be controlled through PIR sensors or daylight cut-off devices.

Carbon Dioxide Emissions After Energy Efficiency Proposals

- 2.11 The energy efficiency measures detailed in Paragraphs 2.4 to 2.10 will reduce the predicted carbon dioxide emissions of the whole development from **260,457 kgCO₂/year** to **232,700 kgCO₂/year**. This

is a reduction of **27,757 kgCO₂/year**, or **10.66%** proportionally. A full dwelling type breakdown is provided in Table 4 below and examples of detailed calculations are provided in the Appendix.

Table 4: Carbon Dioxide Emissions After Energy Efficiency Measures (kgCO₂/year)

Dwelling Type	Dwelling Type Carbon Dioxide Emissions (kgCO ₂ /year)	Number of dwellings	Total Carbon Dioxide Emissions (kgCO ₂ /year)
Block 1			
1BA	890	29	25,810
2BA	1,018	70	71,260
3BA	1,105	2	2,210
Block 2			
1BA	899	6	5,394
2BA	1,030	9	9,270
3BA	1,116	2	2,232
Block 3			
1BA	893	4	3,572
2BA	1,021	11	11,231
3BA	1,108	3	3,324
Block 4			
1BA	904	4	3,616
2BA	1,032	9	9,288
3BA	1,119	4	4,476
Block 5			
1BA	890	2	1,780
2BA	1,119	6	6,714
3BA	1,106	3	3,318
Houses			
Two bed house	1,401	1	1,401
Three bed houses and townhouses	1,474	46	67,804
TOTAL		211	232,700

- 2.12 In order to comply with Condition 22, at least 50% of the dwellings (thus, minimum of 106 dwellings) must deliver a reduction in carbon dioxide emissions of at least 19%. None of the dwellings deliver a 19% reduction through energy efficiency measures alone, thus necessitating the installation of renewable or low carbon technologies to deliver further reductions in emissions.

3.0 Renewable Energy Proposals

Renewable Energy Technologies

- 3.1 This section of the Statement conducts a thorough review of the 'green' renewable energy and low carbon technologies that could theoretically be applied to the proposed development. Renewable energy is defined as *"those energy flows that occur naturally and repeatedly in the environment – from the wind, the fall of water, the movement of oceans, from the sun and also from biomass"* (London Plan, 2015). This definition has been widened by the UK Government through the use of the term 'Low or Zero Carbon Technologies' (LZC), which include heat pumps and gas-fired CHP – technologies not always considered as being renewable, but falling under the bracket of 'clean' technologies. The technologies to be evaluated in this Statement are as follows:

- Combined Heat and Power
- Biomass
- Heat pumps (ground source and air source)
- Hydroelectric power
- Wind energy
- Solar thermal panels
- Solar photovoltaic panels

Combined Heat and Power (CHP)

- 3.2 CHP is a form of decentralised energy generation that generally uses gas to generate electricity for local consumption, reducing the need for grid electricity and its associated high carbon dioxide emissions. As the CHP system is close to the point of energy demand, it is possible to use the heat that is generated during the electricity generation process. As both the electricity and heat from the generator is used, the efficiency of the system is increased above that of a conventional power plant where the heat is not utilised. However, the overall efficiency of approximately 75% is still lower

than the 90% efficiency of a heat only gas boiler. CHP is suitable for dense, mixed-use developments where there is a high, constant and varied heat demand. This is not the case at the development proposed at Portman Road, which is entirely residential and of insufficient scale to prevent an over-generation and subsequent dumping of heat.

Biomass

- 3.3 Biomass community heating is an alternative to conventional fossil fuel heating but, as per the reasons used against the installation of gas-fuelled CHP, should largely be discounted as an option for the proposed dwellings. Biomass boilers burn woodchip, wood pellets, cereal waste or a combination of organic fuels, and are virtually a carbon neutral option. Using biomass as an energy source creates a 'closed carbon cycle' i.e. as a biomass energy source grows it absorbs carbon dioxide from the atmosphere. When it is burnt, the carbon dioxide stored by the biomass is released, making it carbon neutral. Biomass is usually installed with a standard gas boiler as back-up in case the occupier runs out of fuel. Although they are reducing in size, they are still large enough to require a dedicated room within all dwellings with additional space allocated for the fuel. The management of fuel deliveries and ash dispersal is also complex, necessitating a dedicated operative as opposed to residents of the future development. For nearly all of the proposed apartment types at Portman Road, there is insufficient space to incorporate the necessary infrastructure. Furthermore, the emissions of Nitrous Oxide and particulate matter that are associated with biomass installations would have the capacity to worsen local air pollution. Indeed, Nitrous Oxide emissions from a biomass boiler are typically five to ten times higher than the proposed gas boiler alternative.

Ground and Air Source Heat Pumps (GSHPs)

- 3.4 Neither of these technologies has been considered for implementation at the proposed development due to their higher carbon dioxide emissions compared to the proposed gas boiler specification. Although both technologies are renowned for delivering reductions in carbon dioxide emissions, they do so from a much higher baseline than when gas is the specified fuel for space heating and hot water generation. Electricity consumption is also associated with much higher Nitrous Oxide emissions than Class 5 gas boilers.

Hydroelectric power

- 3.5 Hydroelectric power plants generate electricity using the gravitational force of flowing or falling water. However, there are no rivers of sufficient scale in the vicinity of the proposed development to facilitate a hydroelectric power installation.

Wind Turbines

- 3.6 Wind turbines are a modern, high-technology descendant of the windmills that have been around for centuries. In modern windmills the kinetic energy of the wind is used to turn a turbine to generate electricity as opposed to moving water or turning a grist mill wheel. A site with an average wind speed of 5m/s or more is generally considered to be suitable for installing a wind turbine. The average wind speed at the proposed development is 4.6m/s at 10m AOD and is below the level required to generate significant carbon dioxide reductions or commercial take-up. The installation of a single, large wind turbine to serve the development would also be controversial due to the nature of the locality. Even if space could be found within the development to accommodate a very high (15-20m) turbine, their installation would then present a significant visual blight to neighbours.

Solar thermal and photovoltaic panels

- 3.7 Solar thermal heating panels contribute to the hot water demand of a dwelling. Water or glycol (heat transfer liquid) is circulated to roof level where it is heated using solar energy before being returned to a thermal store where heat is exchanged with water from the conventional system. The proposed dwellings generally contain suitable attributes (orientation, available roof-space and limited shadowing) for solar photovoltaic installations to be designed-in, although solar thermal installations are less suitable due to the long pipe runs from the roof to ground floor apartments, which would be associated with considerable heat losses. Furthermore, smaller types, such as the one bedroom apartments, have very little space to accommodate a hot water cylinder.
- 3.8 In contrast, there are few constraints on the capacity for solar photovoltaic panels to deliver reductions in emissions, with large swathes of flat roof space available and no threat of overshadowing from surrounding buildings or natural features.
- 3.9 The Client's preference is to comply with Condition 22 through the specification of solar photovoltaic panels to all apartments in Block 1 (plots 46-146) and five apartments in Block 5 (plots

207-211). In total, this amounts to solar photovoltaic provision to 106 apartments, or 50.24% in proportional terms.

- 3.10 In the case of Block 1, where all dwellings will be provided with solar photovoltaic installations, energy efficiency measures delivered a **14,970 kgCO₂/year** reduction on the baseline scenario, or **13.10%**. In order to deliver a 19% reduction for Block 1 overall, a total reduction in emissions of **21,708 kgCO₂/year**, must be delivered. Thus, for Block 1, a further reduction in emissions of **6,738 kgCO₂/year** must be secured through solar photovoltaic installations.
- 3.11 In the case of Block 5, where plots 207-11 will be provided with solar photovoltaic installations, energy efficiency measures delivered a **263 kgCO₂/year** reduction on the baseline scenario, or **15.23%**. In order to deliver a 19% reduction for Block 5 overall, a total reduction in emissions of **490 kgCO₂/year**, must be delivered. Thus, for Block 5, a further reduction in emissions of **227 kgCO₂/year** must be secured through solar photovoltaic installations.
- 3.12 Further SAP calculations have been undertaken to assess the level of solar photovoltaic provision necessary for the 106 selected dwellings in Blocks 1 and 5 to all deliver a 19% reduction in carbon dioxide emissions. For Block 1, a total of **16 kWp** is required, equivalent to approximately 103 m² in panel area. For Block 5, a total of **0.75 kWp** is required, equivalent to approximately 7.5 m² in panel area.
- 3.13 Table 5 below summarises the reductions in carbon dioxide emissions secured through the Client's strategy of energy efficiency measures and solar photovoltaic installations.

Table 5: Emission Reductions – Blocks 1 and 5

Dwellings	Baseline (kgCO₂/yr)	Reductions from energy efficiency measures (kgCO₂/yr)	Reductions from solar PV (kgCO₂/yr)	Total reductions (kgCO₂/yr)
Block 1 (plots 46-146)	114,250	14,970	6,928	21,898
Block 5 (plots 207-211)	2,578	263	325	588
Total	116,828	15,233	7,253	22,486

- 3.14 In the case of Block 1 (all plots), carbon dioxide emissions are projected to reduce by **21,898 kgCO₂/year**, which is a **19.17%** reduction compared to the baseline scenario. In the case of Block 5 (plots 207-211), carbon dioxide emissions are projected to reduce by **588 kgCO₂/year**, which is a **22.80%** reduction compared to the baseline scenario.
- 3.15 Examples of detailed SAP calculations for common dwelling types in Blocks 1 and 5 are included in the Appendix to this Statement, which demonstrate compliance with the 19% emissions reduction requirement set by Condition 22.

4.0 Conclusion

- 4.1 This Energy Statement has set out the Client's detailed energy strategy pertaining to their development at Portman Road, Reading. The strategy has been developed to comply in full with the requirements of Planning Condition 22 and the underpinning Policy CS1 (Sustainable Construction and Design) of Reading Borough Council's Core Strategy. The focus of the Client's strategy has been to reduce energy consumption at the point of demand by introducing a robust fabric specification and efficient heating and ventilation systems across the site. These measures result in a 10.66% reduction in carbon dioxide emissions across the site. In addition, as required by Condition 22, solar photovoltaic panels (10.50 kWp in total) will be installed to serve all dwellings in Block 1 and plots 207-211 in Block 5. In so doing, a total of **106 dwellings** will deliver **at least a 19%** reduction in carbon dioxide emissions. This is equivalent to **50.24%** of the site's dwellings and this exceeds the 50% requirement set by Condition 22.
- 4.2 Once the dwellings are built and as required by Condition 23, as built compliance reports will be compiled and a report filed to verify that the development has been built out in accordance with the measures proposed in this Statement.

Appendix

Example SAP Worksheet calculations:

1B GF apartment with solar PV

2B MF apartment with solar PV

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECBATES001				Issued on Date	09/08/2018
Survey Reference	001	Prop Type Ref	1BA GF			
Property	Portman Road, Reading, Berkshire, RG30					
SAP Rating		84 B	DER	15.84	TER	19.62
Environmental		90 B	% DER<TER	19.28		
CO ₂ Emissions (t/year)		0.68	DFEE	40.95	TTEE	48.22
General Requirements Compliance		Pass	% DFEE<TTEE	15.09		
Surveyor	Stephen Smith, Tel: 01635 261582				Surveyor ID	d168-0001
Client	Bellway Homes Thames Valley					

SAP2012 - 9.92 input data (DesignData) -

SAP2012 Input Data (Flat)	09/08/2018
FullRefNo:	001
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	RG30
DwellingOrientation:	South
Property Type:	Flat, Semi-Detached
Storeys:	1
Date Built:	2018
Sheltered Sides:	2
Sunlight Shade:	Average or unknown
Measurements	Perimeter, Floor Area, Storey Height
1st Storey:	13.48, 53.38, 2.4
Living Area:	21.1 m2, fraction: 39.5%
Thermal Mass:	Simple calculation
Thermal Mass Simple:	Medium
Thermal MassValue:	250
External Walls	Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1	21.37, 32.35, 0, Other, Cavity, 0, 0.2, Calculate
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	34.14, 0, Other, FilledWithEdge, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings	Area, Kappa, Construction, Element
Party Ceilings 1	53.38, 0, Other
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Heat Loss Floor 1	53.38, 0, Other, Ground Floor - Solid, 0, 0.11
Description	Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1	Manufacturer, Solid Door, , , , , , ,
Opening Type 2	Manufacturer, Window, Double Low-E Hard 0.15, , , 0.72, , 0.7,
Openings	Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Opening 1	Solid Door, External Wall 1, South, , , , 0, 0, 0, 1.95,
Opening 2	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 1.44,
Opening 3	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 1.26,
Opening 4	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 5.25,
Opening 5	Window, External Wall 1, West, , None, 0, , 0, 0, 0, 1.08,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	No
Thermal Bridges	
Bridging:	Calculate Bridges
Y	0.088
List of Bridges	Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
0.	External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
1.	External wall, E2 Other lintels (including other steel lintels), Table K1 - Approved, Yes, 6.73, 0.3, 0.3, 2.02, ACD
2.	External wall, E3 Sill, Independently assessed, Yes, 5.8, 0.045, 0.045, 0.26, CD0027
3.	External wall, E4 Jamb, Independently assessed, Yes, 15.3, 0.051, 0.051, 0.78, CD0028
4.	External wall, E5 Ground floor (normal), Independently assessed, Yes, 13.48, 0.064, 0.064, 0.86, CD0022
5.	External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
6.	External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
7.	External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
8.	External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
9.	External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Independently assessed, No, 13.48, 0.058, 0.058, 0.78, CD0030
11.	External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
12.	External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
13.	External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation, , No, 0, 0, 0, 0.00,
14.	External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
15.	External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
16.	External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
17.	External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
18.	External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
19.	External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
20.	External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
21.	External wall, E16 Corner (normal), Independently assessed, Yes, 4.8, 0.057, 0.057, 0.27, CD0035
22.	External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
23.	External wall, E18 Party wall between dwellings, Independently assessed, Yes, 4.8, 0.062, 0.062, 0.30, CD0037
24.	External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
25.	Party wall, P1 Party wall - Ground floor, Table K1 - Default, No, 14.17, 0.16, 0.16, 2.27, Default
26.	Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
27.	Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
28.	Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 14.17, 0, 0, 0.00,
Default	
29.	Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30.	Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
31.	Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32.	Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,
33.	External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34.	External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



SAP2012 - 9.92 input data (DesignData) -

35.	External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36.	External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
37.	External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
38.	External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39.	External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	5
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows half open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	3.00
Approved Installation	Yes
Data Type	Database
Type	Mechanical extract ventilation - centralised
Database Ref Number	500295
Configuration	0
Manufacturer SFP	0
Duct Type	Rigid
Wet Rooms	2
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:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	None
Light Fittings:	12
LEL Fittings:	12
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	
Description	
Percentage	100
Sedbuk ID	17929
Fuel Type	Mains gas
MHS	Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Split Efficiencies
Efficiency Winter	90.5
Efficiency Summer	87.3
Controls by PCDF	0
MHS Controls	CBI Time and temperature zone control
Boiler Interlock	Yes
Compensator	0
Delayed Start Stat	Yes
Ctrl SAP Code	2110
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)
Combi boiler type	Standard Combi
Combi keep hot type	None
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
MHS	HWP From main heating 1
Low Water Usage	Yes
SAP Code	901
Showers in Property	Non-electric only
Hot Water Cylinder	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	One Dwelling
PVUnit 1	Cells Peak = 0.16, Orientation = Horizontal, Elevation = Horizontal, Overshading = None Or Little, , Connected to Dwelling = No
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

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

DWELLING AS DESIGNED

Ground-floor flat, total floor area 53 m²

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

1a TER and DER

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



SAP2012 - 9.92 input data (DesignData) -

Fuel for main heating:Mains gas
 Fuel factor:1.00 (mains gas)
 Target Carbon Dioxide Emission Rate (TER) 19.62 kgCO₂/m²
 Dwelling Carbon Dioxide Emission Rate (DER) 15.84 kgCO₂/m²OK

1b TFEE and DFEE
 Target Fabric Energy Efficiency (TFEE)48.2 kWh/m²/yr
 Dwelling Fabric Energy Efficiency (DFEE)40.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof (no roof)			
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging
 Thermal bridging calculated from linear thermal transmittances for each junction

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

4 Heating efficiency
 Main heating system: Boiler system with radiators or underfloor - Mains gas
 Data from database
 Ideal LOGIC COMBI ESP1 35
 Combi boiler
 Efficiency: 89.6% SEDBUK2009
 Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
 Hot water storage No cylinder

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

Hot water controls: No cylinder

Boiler interlock Yes OK

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

8 Mechanical ventilation
 Continuous extract system
 Specific fan power:
 Maximum 0.00
 0.7 OK

9 Summertime temperature
 Overheating risk (Thames Valley): Medium OK
 Based on:
 Overshading: Average
 Windows facing North: 7.95 m², No overhang
 Windows facing West: 1.08 m², No overhang
 Air change rate: 3.00 ach
 Blinds/curtains: None

10 Key features
 Party wall U-value 0.00 W/m²K
 Floor U-value 0.11 W/m²K
 Door U-value 1.00 W/m²K
 Photovoltaic array

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			9.0300	1.2357	11.1587		(27)
Heat Loss Floor 1			53.3800	0.1100	5.8718		(28a)
External Wall 1	32.3500	10.9800	21.3700	0.2000	4.2740		(29a)
Total net area of external elements Aum(A, m ²)			85.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.2545		(33)
Party Wall 1			34.1400	0.0000	0.0000		(32)
Party Ceilings 1			53.3800				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5433 (36)
Total fabric heat loss							(33) + (36) = 30.7978 (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	22.0237	21.7991	21.5745	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385 (38)
Heat transfer coeff	52.8215	52.5969	52.3723	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363 (39)
Average = Sum(39)m / 12 =												52.1014 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9895	0.9853	0.9811	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730 (40)
HLP (average)												0.9760 (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												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)												Total = Sum(45)m = 1206.8955 (45)
Distribution loss (46)m = 0.15 x (45)m												
	18.7694	16.4158	16.9397	14.7684	14.1706	12.2282	11.3312	13.0027	13.1580	15.3344	16.7387	18.1771 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0100	12.6388	13.9686	13.4904	13.9200	13.4479	13.8817	13.9066	13.4711	13.9485	13.5306	14.0020 (61)
Total heat required for water heating calculated for each month	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830 (64)
Heat gains from water heating, kWh/month	45.1080	39.5481	41.0417	36.1092	34.8916	30.4678	28.5879	32.2994	32.5347	37.4784	40.4868	43.7932 (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	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.3567	12.7515	10.3702	7.8509	5.8687	4.9546	5.3536	6.9588	9.3401	11.8594	13.8416	14.7557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.0015	157.6203	153.5410	144.8565	133.8940	123.5908	116.7076	115.0888	119.1681	127.8525	138.8151	149.1183	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	60.6290	58.8514	55.1636	50.1517	46.8973	42.3164	38.4247	43.4131	45.1871	50.3742	56.2316	58.8618	(72)
Total internal gains	283.8336	282.0696	271.9212	255.7056	239.5063	223.7080	213.3322	218.3070	226.5416	242.9325	261.7347	275.5822	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					7.9500	10.6334	0.7200	0.7000	0.7700	29.5259 (74)		
West					1.0800	19.6403	0.7200	0.7000	0.7700	7.4086 (80)		
Solar gains	36.9344	70.9182	119.7481	188.8182	250.1242	265.7667	248.9312	200.2231	143.0385	84.3640	45.6616	30.7067 (83)
Total gains	320.7680	352.9878	391.6693	444.5238	489.6305	489.4747	462.2634	418.5301	369.5801	327.2965	307.3963	306.2889 (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	70.1788	70.4784	70.7807	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748
alpha	5.6786	5.6986	5.7187	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583
util living area	0.9980	0.9960	0.9889	0.9559	0.8462	0.6538	0.4900	0.5609	0.8386	0.9772	0.9958	0.9984 (86)
MIT	19.9814	20.1018	20.3246	20.6300	20.8751	20.9775	20.9963	20.9924	20.9119	20.5995	20.2440	19.9697 (87)
Th 2	20.0921	20.0956	20.0991	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059 (88)
util rest of house	0.9973	0.9947	0.9850	0.9403	0.7991	0.5729	0.3928	0.4570	0.7713	0.9663	0.9941	0.9979 (89)
MIT 2	18.7270	18.9051	19.2313	19.6692	19.9853	20.0912	20.1046	20.1028	20.0344	19.6335	19.1210	18.7201 (90)
Living area fraction									fLA = Living area / (4) =			0.3953 (91)
MIT	19.2228	19.3781	19.6634	20.0490	20.3370	20.4415	20.4571	20.4544	20.3813	20.0153	19.5649	19.2141 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0728	19.2281	19.5134	19.8990	20.1870	20.2915	20.3071	20.3044	20.2313	19.8653	19.4149	19.0641 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9962	0.9929	0.9817	0.9359	0.8038	0.5904	0.4149	0.4806	0.7819	0.9625	0.9923	0.9971 (94)
Useful gains	319.5518	350.4816	384.4831	416.0289	393.5685	288.9616	191.8041	201.1585	288.9809	315.0125	305.0306	305.3860 (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	780.3231	753.6135	681.5427	571.2466	440.7837	295.5969	192.5307	202.7817	318.4358	481.2062	639.5911	771.9838 (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	342.8138	270.9047	221.0123	111.7567	35.1281	0.0000	0.0000	0.0000	0.0000	123.6481	240.8835	347.1488 (98)
Space heating												1693.2961 (98)
Space heating per m2										(98) / (4) =		31.7215 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1871.0454 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	342.8138	270.9047	221.0123	111.7567	35.1281	0.0000	0.0000	0.0000	0.0000	123.6481	240.8835	347.1488	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	378.7998	299.3422	244.2125	123.4881	38.8156	0.0000	0.0000	0.0000	0.0000	136.6278	266.1697	383.5898	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(64)
Efficiency of water heater (217)m	89.5523	89.4811	89.3060	88.8698	88.0621	87.3000	87.3000	87.3000	87.3000	88.9211	89.3800	87.3000	(216)
Fuel for water heating, kWh/month	155.3719	136.4284	142.0954	125.9668	123.0846	108.7848	102.4320	115.2250	115.9120	130.6529	139.9887	150.9080	(219)
Water heating fuel used												1546.8506	(219)
Annual totals kWh/year													
Space heating fuel - main system												1871.0454	(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)													253.5440 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.16 * 951 * 1.00) =													-121.6788 (233)
Total delivered energy for all uses													3624.7612 (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	1871.0454	0.2160	404.1458 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1546.8506	0.2160	334.1197 (264)
Space and water heating			738.2655 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	253.5440	0.5190	131.5894 (268)
Energy saving/generation technologies			
PV Unit	-121.6788	0.5190	-63.1513 (269)
Total CO2, kg/year			845.6286 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8400 (273)

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

DER		15.8400 ZC1
Total Floor Area	TFA	53.3800
Assumed number of occupants	N	1.7898
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		17.3180 ZC2
CO2 emissions from cooking, equation (L16)		3.0340 ZC3
Total CO2 emissions		36.1919 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		36.1919 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					20.0000 / (5) = 0.1561 (8)
Measured/design q50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4061 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3452 (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												
	0.4401	0.4315	0.4229	0.3797	0.3711	0.3279	0.3279	0.3193	0.3452	0.3711	0.3883	0.4056 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			1.9500	1.0000	1.9500		(26)
TER Opening Type (Uw = 1.40)			9.0300	1.3258	11.9716		(27)
Heat Loss Floor 1			53.3800	0.1300	6.9394		(28a)
External Wall 1	32.3500	10.9800	21.3700	0.1800	3.8466		(29a)
Total net area of external elements Aum(A, m ²)			85.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	24.7076		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3455 (36)
Total fabric heat loss						(33) + (36) =	31.0531 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	25.2332	25.0742	24.9184	24.1863	24.0494	23.4118	23.4118
Heat transfer coeff	56.2863	56.1273	55.9715	55.2394	55.1024	54.4649	54.4649
Average = Sum(39)m / 12 =							
	56.2863	56.1273	55.9715	55.2394	55.1024	54.4649	54.4649
HLP	1.0544	1.0515	1.0485	1.0348	1.0323	1.0203	1.0203
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)												Total = Sum(45)m = 1206.8955 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7694	16.4158	16.9397	14.7684	14.1706	12.2282	11.3312	13.0027	13.1580	15.3344	16.7387	18.1771 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	42.9978	37.4245	39.8707	37.0714	36.7436	34.0452	35.1800	36.7436	37.0714	39.8707	40.0977	42.9978 (61)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total heat required for water heating calculated for each month												
	168.1270	146.8633	152.8018	135.5275	131.2145	115.5664	110.7214	123.4284	124.7916	142.1001	151.6890	164.1788 (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												
	168.1270	146.8633	152.8018	135.5275	131.2145	115.5664	110.7214	123.4284	124.7916	142.1001	151.6890	164.1788 (64)
Total per year (kWh/year) = Sum (64)m =												1667.0097 (64)
Heat gains from water heating, kWh/month												
	52.3549	45.7445	47.5173	42.0045	40.5975	35.6171	33.9125	38.0086	38.4348	43.9589	47.1285	51.0421 (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	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	14.3567	12.7515	10.3702	7.8509	5.8687	4.9546	5.3536	6.9588	9.3401	11.8594	13.8416	14.7557 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	156.0015	157.6203	153.5410	144.8565	133.8940	123.5908	116.7076	115.0888	119.1681	127.8525	138.8151	149.1183 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488 (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)												
	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903 (71)
Water heating gains (Table 5)												
	70.3695	68.0722	63.8673	58.3396	54.5665	49.4682	45.5813	51.0868	53.3817	59.0846	65.4563	68.6050 (72)
Total internal gains												
	293.5741	291.2904	280.6248	263.8934	247.1755	230.8599	220.4888	225.9807	234.7362	251.6429	270.9594	285.3254 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	7.9500	10.6334	0.6300	0.7000	0.7700	25.8351 (74)
West	1.0800	19.6403	0.6300	0.7000	0.7700	6.4825 (80)
Solar gains						
	32.3176	62.0534	104.7796	165.2159	218.8587	232.5458
Total gains						
	325.8918	353.3438	385.4044	429.1093	466.0342	463.4057

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	65.8587	66.0453	66.2292	67.1069	67.2737	68.0612	68.0612	68.2091	67.7557	67.2737	66.9371	66.5888	
alpha	5.3906	5.4030	5.4153	5.4738	5.4849	5.5374	5.5374	5.5473	5.5170	5.4849	5.4625	5.4393	
util living area													
	0.9978	0.9962	0.9906	0.9664	0.8830	0.7066	0.5378	0.6053	0.8660	0.9801	0.9958	0.9983 (86)	
MIT													
	19.8992	20.0117	20.2296	20.5441	20.8185	20.9619	20.9930	20.9871	20.8815	20.5432	20.1734	19.8810 (87)	
Th 2	20.0382	20.0407	20.0431	20.0544	20.0565	20.0664	20.0664	20.0683	20.0626	20.0565	20.0522	20.0477 (88)	
util rest of house													
	0.9971	0.9949	0.9872	0.9536	0.8407	0.6215	0.4284	0.4917	0.8021	0.9702	0.9941	0.9977 (89)	
MIT 2	18.5673	18.7332	19.0519	19.5097	19.8757	20.0408	20.0637	20.0627	19.9636	19.5159	18.9783	18.5477 (90)	
Living area fraction													
	fLA = Living area / (4) =												0.3953 (91)
MIT	19.0937	19.2386	19.5174	19.9186	20.2483	20.4049	20.4310	20.4281	20.3264	19.9219	19.4507	19.0748 (92)	
Temperature adjustment													0.0000
adjusted MIT	19.0937	19.2386	19.5174	19.9186	20.2483	20.4049	20.4310	20.4281	20.3264	19.9219	19.4507	19.0748 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9961	0.9934	0.9848	0.9514	0.8503	0.6538	0.4719	0.5369	0.8224	0.9684	0.9926	0.9969 (94)
Useful gains	324.6260	351.0111	379.5348	408.2579	396.2561	302.9883	206.8492	215.3941	295.9661	315.1673	308.6135	311.2268 (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												
	832.6847	804.7855	728.6024	608.6602	471.0340	316.1617	208.6571	218.9153	340.6509	513.6612	683.9764	828.0662 (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												
	377.9957	304.9364	259.7063	144.2897	55.6348	0.0000	0.0000	0.0000	0.0000	147.6794	270.2613	384.5286 (98)
Space heating												1945.0322 (98)
Space heating per m2												36.4375 (99)
										(98) / (4) =		

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)
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FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2082.4756 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	377.9957	304.9364	259.7063	144.2897	55.6348	0.0000	0.0000	0.0000	0.0000	147.6794	270.2613	384.5286 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	404.7063	326.4844	278.0581	154.4857	59.5662	0.0000	0.0000	0.0000	0.0000	158.1150	289.3590	411.7008 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	168.1270	146.8633	152.8018	135.5275	131.2145	115.5664	110.7214	123.4284	124.7916	142.1001	151.6890	164.1788 (64)
Efficiency of water heater	87.0301	86.8491	86.3757	85.2091	83.0632	80.3000	80.3000	80.3000	80.3000	85.1482	86.4892	80.3000 (216)
Fuel for water heating, kWh/month	193.1827	169.1017	176.9037	159.0529	157.9694	143.9183	137.8847	153.7091	155.4067	166.8856	175.3848	188.4486 (219)
Water heating fuel used												1977.8482 (219)
Annual totals kWh/year												
Space heating fuel - main system												2082.4756 (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)												253.5440 (232)
Total delivered energy for all uses												4388.8678 (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	2082.4756	0.2160	449.8147 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.8482	0.2160	427.2152 (264)
Space and water heating			877.0299 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	253.5440	0.5190	131.5894 (268)
Total CO2, kg/m2/year			1047.5443 (272)
Emissions per m2 for space and water heating			16.4299 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4651 (272b)
Emissions per m2 for pumps and fans			0.7292 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.4299 * 1.00) + 2.4651 + 0.7292, rounded to 2 d.p.			19.6200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1561 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.4061 (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) =		0.3452 (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												
Effective ac	0.4401	0.4315	0.4229	0.3797	0.3711	0.3279	0.3279	0.3193	0.3452	0.3711	0.3883	0.4056 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (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					
Opening Type 1			1.9500	1.0000	1.9500		(26)					
Opening Type 2 (Uw = 1.30)			9.0300	1.2357	11.1587		(27)					
Heat Loss Floor 1			53.3800	0.1100	5.8718		(28a)					
External Wall 1	32.3500	10.9800	21.3700	0.2000	4.2740		(29a)					
Total net area of external elements Aum(A, m2)			85.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	23.2545		(33)					
Party Wall 1			34.1400	0.0000	0.0000		(32)					
Party Ceilings 1			53.3800				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5433 (36)					
Total fabric heat loss						(33) + (36) =	30.7978 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.2332	25.0742	24.9184	24.1863	24.0494	23.4118	23.4118	23.2937	23.6574	24.0494	24.3264	24.6161 (38)
Heat transfer coeff	56.0310	55.8720	55.7162	54.9841	54.8472	54.2096	54.2096	54.0915	54.4552	54.8472	55.1242	55.4139 (39)
Average = Sum(39)m / 12 =												54.9835 (39)
HLP	Jan 1.0497	Feb 1.0467	Mar 1.0438	Apr 1.0301	May 1.0275	Jun 1.0155	Jul 1.0155	Aug 1.0133	Sep 1.0201	Oct 1.0275	Nov 1.0327	Dec 1.0381 (40)
HLP (average)												1.0300 (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												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)										Total = Sum(45)m =		1206.8955 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	26.5900	23.2558	23.9979	20.9219	20.0751	17.3233	16.0525	18.4205	18.6405	21.7237	23.7132	25.7510 (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	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.3567	12.7515	10.3702	7.8509	5.8687	4.9546	5.3536	6.9588	9.3401	11.8594	13.8416	14.7557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.0015	157.6203	153.5410	144.8565	133.8940	123.5908	116.7076	115.0888	119.1681	127.8525	138.8151	149.1183	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	35.7392	34.6068	32.2552	29.0582	26.9826	24.0601	21.5760	24.7588	25.8896	29.1986	32.9349	34.6115	(72)
Total internal gains	255.9438	254.8250	246.0127	231.6120	216.5916	202.4518	193.4835	196.6527	204.2442	218.7568	235.4380	248.3319	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				7.9500	10.6334	0.7200	0.7000	0.7700	29.5259 (74)			
West				1.0800	19.6403	0.7200	0.7000	0.7700	7.4086 (80)			
Solar gains	36.9344	70.9182	119.7481	188.8182	250.1242	265.7667	248.9312	200.2231	143.0385	84.3640	45.6616	30.7067 (83)
Total gains	292.8782	325.7432	365.7609	420.4302	466.7158	468.2184	442.4147	396.8758	347.2826	303.1208	281.0996	279.0386 (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	66.1588	66.3471	66.5327	67.4185	67.5868	68.3817	68.3817	68.5310	68.0733	67.5868	67.2471	66.8956	
alpha	5.4106	5.4231	5.4355	5.4946	5.5058	5.5588	5.5588	5.5687	5.5382	5.5058	5.4831	5.4597	
util living area	0.9987	0.9974	0.9926	0.9689	0.8813	0.6988	0.5310	0.6087	0.8783	0.9853	0.9974	0.9990	(86)
MIT	19.8473	19.9696	20.2019	20.5360	20.8222	20.9644	20.9935	20.9870	20.8726	20.5110	20.1265	19.8287	(87)
Th 2	20.0422	20.0446	20.0470	20.0584	20.0605	20.0704	20.0704	20.0722	20.0666	20.0605	20.0562	20.0517	(88)
util rest of house	0.9983	0.9965	0.9899	0.9568	0.8387	0.6141	0.4231	0.4951	0.8175	0.9778	0.9963	0.9987	(89)
MIT 2	18.9854	19.1094	19.3424	19.6784	19.9397	20.0541	20.0687	20.0684	19.9927	19.6601	19.2757	18.9746	(90)
Living area fraction	19.3261	19.4494	19.6822	20.0174	20.2886	20.4139	20.4343	20.4315	20.3405	19.9964	19.6120	19.3122	(91)
MIT	19.3261	19.4494	19.6822	20.0174	20.2886	20.4139	20.4343	20.4315	20.3405	19.9964	19.6120	19.3122	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3261	19.4494	19.6822	20.0174	20.2886	20.4139	20.4343	20.4315	20.3405	19.9964	19.6120	19.3122	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9978	0.9958	0.9885	0.9562	0.8502	0.6468	0.4661	0.5405	0.8377	0.9771	0.9957	0.9983	(94)
Ext temp.	292.2468	324.3696	361.5622	402.0218	396.7937	302.8391	206.1880	214.4990	290.9231	296.1831	279.8823	278.5771	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	841.9259	812.9056	734.4593	611.2798	471.0587	315.1703	207.8536	218.0693	339.8268	515.3681	689.7156	837.4258	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	408.9612	328.2962	277.4354	150.6658	55.2532	0.0000	0.0000	0.0000	0.0000	163.0736	295.0800	415.7834	(98)
Space heating per m2												2094.5488	(98)
												39.2385	(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	509.5699	401.1508	411.0954	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9149	0.9574	0.9334	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	466.2039	384.0643	383.7218	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	614.8701	583.4324	531.2804	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	107.0397	148.3299	109.7836	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												365.1531	(104)
Cooled fraction												1.0000	(105)

fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	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	26.7599	37.0825	27.4459	0.0000	0.0000	0.0000 (107)
Space cooling											91.2883 (107)
Space cooling per m2											1.7102 (108)
Energy for space heating											39.2385 (99)
Energy for space cooling											1.7102 (108)
Total											40.9486 (109)
Dwelling Fabric Energy Efficiency (DFEE)											40.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	+	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				2 * 10 =	20.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				20.0000 / (5) =	0.1561 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.4061 (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) =		0.3452 (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												
Effective ac	0.4401	0.4315	0.4229	0.3797	0.3711	0.3279	0.3279	0.3193	0.3452	0.3711	0.3883	0.4056 (22b)
Effective ac	0.5969	0.5931	0.5894	0.5721	0.5689	0.5538	0.5538	0.5510	0.5596	0.5689	0.5754	0.5823 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9500	1.0000	1.9500		(26)					
TER Opening Type (Uw = 1.40)			9.0300	1.3258	11.9716		(27)					
Heat Loss Floor 1			53.3800	0.1300	6.9394		(28a)					
External Wall 1	32.3500	10.9800	21.3700	0.1800	3.8466		(29a)					
Total net area of external elements Aum(A, m2)			85.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	24.7076		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.3455 (36)					
Total fabric heat loss						(33) + (36) =	31.0531 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	25.2332	25.0742	24.9184	24.1863	24.0494	23.4118	23.4118	23.2937	23.6574	24.0494	24.3264	24.6161 (38)
Heat transfer coeff	56.2863	56.1273	55.9715	55.2394	55.1024	54.4649	54.4649	54.3468	54.7104	55.1024	55.3795	55.6692 (39)
Average = Sum(39)m / 12 =												55.2388 (39)
HLP	1.0544	1.0515	1.0485	1.0348	1.0323	1.0203	1.0203	1.0181	1.0249	1.0323	1.0375	1.0429 (40)
HLP (average)												1.0348 (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												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)										Total = Sum(45)m =		1206.8955 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat gains from water heating, kWh/month
26.5900 23.2558 23.9979 20.9219 20.0751 17.3233 16.0525 18.4205 18.6405 21.7237 23.7132 25.7510 (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	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	89.4878	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	14.3567	12.7515	10.3702	7.8509	5.8687	4.9546	5.3536	6.9588	9.3401	11.8594	13.8416	14.7557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	156.0015	157.6203	153.5410	144.8565	133.8940	123.5908	116.7076	115.0888	119.1681	127.8525	138.8151	149.1183	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	31.9488	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	35.7392	34.6068	32.2552	29.0582	26.9826	24.0601	21.5760	24.7588	25.8896	29.1986	32.9349	34.6115	(72)
Total internal gains	255.9438	254.8250	246.0127	231.6120	216.5916	202.4518	193.4835	196.6527	204.2442	218.7568	235.4380	248.3319	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b			FF Specific data or Table 6c	Access factor Table 6d		Gains W
North				7.9500	10.6334	0.6300			0.7000	0.7700		25.8351 (74)
West				1.0800	19.6403	0.6300			0.7000	0.7700		6.4825 (80)

Solar gains	32.3176	62.0534	104.7796	165.2159	218.8587	232.5458	217.8148	175.1952	125.1587	73.8185	39.9539	26.8683 (83)
Total gains	288.2614	316.8784	350.7924	396.8280	435.4503	434.9976	411.2983	371.8479	329.4028	292.5753	275.3919	275.2003 (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	65.8587	66.0453	66.2292	67.1069	67.2737	68.0612	68.0612	68.2091	67.7557	67.2737	66.9371	66.5888	
alpha	5.3906	5.4030	5.4153	5.4738	5.4849	5.5374	5.5374	5.5473	5.5170	5.4849	5.4625	5.4393	
util living area	0.9988	0.9977	0.9939	0.9758	0.9057	0.7403	0.5701	0.6460	0.8979	0.9876	0.9977	0.9991	(86)
MIT	19.8325	19.9475	20.1702	20.4947	20.7877	20.9521	20.9907	20.9824	20.8529	20.4892	20.1108	19.8152	(87)
Th 2	20.0382	20.0407	20.0431	20.0544	20.0565	20.0664	20.0664	20.0683	20.0626	20.0565	20.0522	20.0477	(88)
util rest of house	0.9984	0.9970	0.9917	0.9660	0.8684	0.6556	0.4557	0.5282	0.8424	0.9811	0.9967	0.9988	(89)
MIT 2	18.9674	19.0842	19.3079	19.6360	19.9085	20.0438	20.0639	20.0629	19.9749	19.6357	19.2569	18.9579	(90)
Living area fraction									fLA = Living area / (4) =			0.3953	(91)
MIT	19.3093	19.4254	19.6487	19.9754	20.2560	20.4028	20.4303	20.4264	20.3219	19.9731	19.5944	19.2968	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3093	19.4254	19.6487	19.9754	20.2560	20.4028	20.4303	20.4264	20.3219	19.9731	19.5944	19.2968	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9963	0.9905	0.9650	0.8773	0.6879	0.5013	0.5753	0.8601	0.9803	0.9961	0.9984	(94)
Useful gains	287.6837	315.7015	347.4430	382.9464	382.0276	299.2297	206.1899	213.9133	283.3236	286.8140	274.3078	274.7732	(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	844.8197	815.2733	735.9534	611.7998	471.4590	316.0512	208.6147	218.8199	340.4052	516.4794	691.9348	840.4244	(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	414.5092	335.7122	289.0517	164.7745	66.5370	0.0000	0.0000	0.0000	0.0000	170.8710	300.6914	420.8445	(98)
Space heating												2162.9914	(98)
Space heating per m2												40.5206	(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	511.9696	403.0399	413.0355	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8923	0.9439	0.9167	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	456.8117	380.4289	378.6451	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	576.0406	547.0626	502.0271	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	85.8448	123.9754	91.7962	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												301.6164	(104)
Cooled fraction												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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	21.4612	30.9939	22.9490	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												75.4041 (107)
Space cooling per m2												1.4126 (108)
Energy for space heating												40.5206 (99)
Energy for space cooling												1.4126 (108)
Total												41.9332 (109)
Target Fabric Energy Efficiency (TFEE)												48.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design q50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.2500 (18)
					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2338	0.2178	0.2178	0.2072	0.2072	0.1806	0.1806	0.1753	0.1806	0.2019	0.1966	0.2125 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			9.0300	1.2357	11.1587		(27)
Heat Loss Floor 1			53.3800	0.1100	5.8718		(28a)
External Wall 1	32.3500	10.9800	21.3700	0.2000	4.2740		(29a)
Total net area of external elements Aum(A, m ²)			85.7300				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 23.2545		(33)
Party Wall 1			34.1400	0.0000	0.0000		(32)
Party Ceilings 1			53.3800				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	7.5433 (36)
Total fabric heat loss	(33) + (36) = 30.7978 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385 (38)
Average = Sum(39)m / 12 =	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363 (39)
												51.9363 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730 (40)
Days in month												0.9730 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)	Total = Sum(45)m =										1206.8955 (45)	
Distribution loss (46)m = 0.15 x (45)m												
	18.7694	16.4158	16.9397	14.7684	14.1706	12.2282	11.3312	13.0027	13.1580	15.3344	16.7387	18.1771 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0100	12.6388	13.9686	13.4904	13.9200	13.4479	13.8817	13.9066	13.4711	13.9485	13.5306	14.0020 (61)
Total heat required for water heating calculated for each month	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830 (64)
RHI water heating demand	45.1080	39.5481	41.0417	36.1092	34.8916	30.4678	28.5879	32.2994	32.5347	37.4784	40.4868	43.7932 (65)
Heat gains from water heating, kWh/month	45.1080	39.5481	41.0417	36.1092	34.8916	30.4678	28.5879	32.2994	32.5347	37.4784	40.4868	43.7932 (65)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Total per year (kWh/year) = Sum(64)m =												1371.1116 (64)
												1371 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.8918	31.8788	25.9256	19.6273	14.6716	12.3864	13.3840	17.3970	23.3502	29.6484	34.6041	36.8893	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.8381	235.2542	229.1657	216.2038	199.8418	184.4638	174.1904	171.7743	177.8628	190.8247	207.1867	222.5647	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	60.6290	58.8514	55.1636	50.1517	46.8973	42.3164	38.4247	43.4131	45.1871	50.3742	56.2316	58.8618	(72)
Total internal gains	415.6823	412.3078	396.5783	372.3063	347.7342	325.4900	312.3224	318.9078	332.7236	357.1707	384.3458	404.6392	(73)

6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					7.9500	12.7500	0.7200		0.7000			35.4030	(74)
West					1.0800	23.7835	0.7200		0.7000			8.9715	(80)
Solar gains	44.3745	75.0334	126.9092	204.0027	263.0535	295.2350	273.9965	225.0416	161.9919	96.1627	54.1650	37.0237	(83)
Total gains	460.0568	487.3412	523.4875	576.3089	610.7877	620.7250	586.3190	543.9494	494.7154	453.3334	438.5108	441.6629	(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	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	
alpha	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	
util living area	0.9853	0.9773	0.9484	0.8597	0.6749	0.4493	0.3010	0.3432	0.6306	0.8894	0.9711	0.9879	(86)
MIT	20.3039	20.4024	20.6090	20.8337	20.9657	20.9971	20.9998	20.9995	20.9818	20.8265	20.5278	20.2730	(87)
Th 2	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	(88)
util rest of house	0.9809	0.9705	0.9331	0.8233	0.6127	0.3762	0.2219	0.2583	0.5484	0.8509	0.9611	0.9842	(89)
MIT 2	19.2047	19.3455	19.6356	19.9303	20.0783	20.1045	20.1059	20.1058	20.0945	19.9291	19.5263	19.1605	(90)
Living area fraction	19.6392	19.7632	20.0204	20.2874	20.4291	20.4573	20.4592	20.4591	20.4452	20.2839	19.9222	19.6003	(92)
Temperature adjustment	19.4892	19.6132	19.8704	20.1374	20.2791	20.3073	20.3092	20.3091	20.2952	20.1339	19.7722	19.4503	(93)
adjusted MIT	19.4892	19.6132	19.8704	20.1374	20.2791	20.3073	20.3092	20.3091	20.2952	20.1339	19.7722	19.4503	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	449.4787	470.7170	485.9719	475.3022	381.8756	243.7875	140.6781	151.0186	280.1909	386.3708	419.4040	433.1072	(94)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W	757.7089	732.9893	652.8587	542.0809	393.6288	244.4818	140.7069	151.0869	285.4020	453.6039	621.7908	755.6860	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	229.3233	176.2470	124.1638	48.0807	8.7444	0.0000	0.0000	0.0000	0.0000	50.0215	145.7185	239.9986	(98)
Space heating												1022.2978	(98)
RHI space heating demand												1022	(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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			9.0300	1.2357	11.1587		(27)
Heat Loss Floor 1			53.3800	0.1100	5.8718		(28a)
External Wall 1	32.3500	10.9800	21.3700	0.2000	4.2740		(29a)
Total net area of external elements Aum(A, m ²)			85.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.2545		(33)
Party Wall 1			34.1400	0.0000	0.0000		(32)
Party Ceilings 1			53.3800				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5433 (36)
Total fabric heat loss							(33) + (36) = 30.7978 (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	22.0237	21.7991	21.5745	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385 (38)
Heat transfer coeff	52.8215	52.5969	52.3723	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363 (39)
Average = Sum(39)m / 12 =												52.1014 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9895	0.9853	0.9811	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730 (40)
HLP (average)												0.9760 (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												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy content (annual)	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1206.8955 (45)
Water storage loss:	18.7694	16.4158	16.9397	14.7684	14.1706	12.2282	11.3312	13.0027	13.1580	15.3344	16.7387	18.1771 (46)

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0100	12.6388	13.9686	13.4904	13.9200	13.4479	13.8817	13.9066	13.4711	13.9485	13.5306	14.0020	(61)
Total heat required for water heating calculated for each month	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(64)
Heat gains from water heating, kWh/month	45.1080	39.5481	41.0417	36.1092	34.8916	30.4678	28.5879	32.2994	32.5347	37.4784	40.4868	43.7932	(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	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.8918	31.8788	25.9256	19.6273	14.6716	12.3864	13.3840	17.3970	23.3502	29.6484	34.6041	36.8893	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.8381	235.2542	229.1657	216.2038	199.8418	184.4638	174.1904	171.7743	177.8628	190.8247	207.1867	222.5647	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	60.6290	58.8514	55.1636	50.1517	46.8973	42.3164	38.4247	43.4131	45.1871	50.3742	56.2316	58.8618	(72)
Total internal gains	415.6823	412.3078	396.5783	372.3063	347.7342	325.4900	312.3224	318.9078	332.7236	357.1707	384.3458	404.6392	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
North					7.9500	10.6334	0.7200		0.7000			0.7700			29.5259 (74)
West					1.0800	19.6403	0.7200		0.7000			0.7700			7.4086 (80)
Solar gains	36.9344	70.9182	119.7481	188.8182	250.1242	265.7667	248.9312	200.2231	143.0385	84.3640	45.6616			30.7067 (83)	
Total gains	452.6167	483.2260	516.3264	561.1245	597.8584	591.2567	561.2537	519.1309	475.7620	441.5347	430.0074			435.3459 (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	70.1788	70.4784	70.7807	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748		
alpha	5.6786	5.6986	5.7187	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583		
util living area	0.9889	0.9820	0.9619	0.8957	0.7484	0.5531	0.4058	0.4573	0.7106	0.9231	0.9789	0.9908	(86)	
MIT	20.2125	20.3248	20.5231	20.7713	20.9353	20.9902	20.9986	20.9973	20.9631	20.7590	20.4528	20.1979	(87)	
Th 2	20.0921	20.0956	20.0991	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	(88)	
util rest of house	0.9855	0.9767	0.9506	0.8671	0.6936	0.4798	0.3241	0.3700	0.6346	0.8952	0.9717	0.9880	(89)	
MIT 2	19.0619	19.2262	19.5105	19.8518	20.0477	20.0999	20.1054	20.1049	20.0792	19.8438	19.4199	19.0516	(90)	
Living area fraction									fLA = Living area / (4) =			0.3953	(91)	
MIT	19.5167	19.6604	19.9107	20.2153	20.3985	20.4518	20.4585	20.4576	20.4286	20.2056	19.8282	19.5047	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	19.3667	19.5104	19.7607	20.0653	20.2485	20.3018	20.3085	20.3076	20.2786	20.0556	19.6782	19.3547	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	444.5106	469.8756	488.1718	485.7491	420.2018	293.3473	192.3371	202.3929	309.2654	394.4346	415.9493	428.7981	(94)
Ext temp.	4.3000	4.9000	6.5000	8.5000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	795.8448	768.4632	694.4946	579.8825	443.9793	296.1309	192.6048	202.9476	320.8945	491.0865	653.2638	787.0782	(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	261.3927	200.6509	153.5042	67.7761	17.6904	0.0000	0.0000	0.0000	0.0000	71.9090	170.8665	266.5604	(98)
Space heating												1210.3501	(98)
Space heating per m2										(98) / (4) =		22.6742	(99)

8c. Space cooling requirement

Not applicable

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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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1337.4035 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	261.3927	200.6509	153.5042	67.7761	17.6904	0.0000	0.0000	0.0000	0.0000	71.9090	170.8665	266.5604	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	288.8317	221.7137	169.6179	74.8907	19.5474	0.0000	0.0000	0.0000	0.0000	79.4575	188.8027	294.5419	(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	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(64)
Efficiency of water heater	89.3621	89.2623	89.0232	88.4798	87.7353	87.3000	87.3000	87.3000	87.3000	88.4963	89.1191	87.3000	(216)
(217)m	89.3621	89.2623	89.0232	88.4798	87.7353	87.3000	87.3000	87.3000	87.3000	88.4963	89.1191	89.3974	(217)
Fuel for water heating, kWh/month	155.7027	136.7628	142.5467	126.5220	123.5432	108.7848	102.4320	115.2250	115.9120	131.2799	140.3986	151.2158	(219)
Water heating fuel used												1550.3255	(219)
Annual totals kWh/year													
Space heating fuel - main system												1337.4035	(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)												253.5440	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.16 * 951 * 1.00) =												-121.6788	(233)
Total delivered energy for all uses												3094.5942	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1337.4035	3.4800	46.5416	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1550.3255	3.4800	53.9513	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	253.5440	13.1900	33.4425	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	0.0000	0.0000	0.0000	(252)
Total energy cost			263.8279	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	1.1263	(257)
SAP value	84.2878	
SAP rating (Section 12)	84	(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	1337.4035	0.2160	288.8792	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1550.3255	0.2160	334.8703	(264)
Space and water heating			623.7495	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	253.5440	0.5190	131.5894	(268)
Energy saving/generation technologies				
PV Unit	-121.6788	0.5190	-63.1513	(269)
Total kg/year			731.1125	(272)
CO2 emissions per m2			13.7000	(273)
EI value			90.0418	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8834 = 3.939$, stars = 4
Water heating environmental impact	$0.216 / 0.8834 = 0.2445$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.3800 (1b)	x 2.4000 (2b)	= 128.1120 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	53.3800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 128.1120 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2338	0.2178	0.2178	0.2072	0.2072	0.1806	0.1806	0.1753	0.1806	0.2019	0.1966	0.2125 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			9.0300	1.2357	11.1587		(27)
Heat Loss Floor 1			53.3800	0.1100	5.8718		(28a)
External Wall 1	32.3500	10.9800	21.3700	0.2000	4.2740		(29a)
Total net area of external elements Aum(A, m ²)			85.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		23.2545		(33)
Party Wall 1			34.1400	0.0000	0.0000		(32)
Party Ceilings 1			53.3800				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5433 (36)
Total fabric heat loss							(33) + (36) = 30.7978 (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	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385	21.1385 (38)
Heat transfer coeff	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363	51.9363 (39)
Average = Sum(39)m / 12 =												51.9363 (39)
HLP	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730	0.9730 (40)
HLP (average)												0.9730 (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												1.7898 (42)
Average daily hot water use (litres/day)												76.7067 (43)
Daily hot water use	84.3774	81.3091	78.2409	75.1726	72.1043	69.0361	69.0361	72.1043	75.1726	78.2409	81.3091	84.3774 (44)
Energy conte	125.1292	109.4388	112.9311	98.4560	94.4709	81.5212	75.5414	86.6849	87.7201	102.2294	111.5914	121.1810 (45)
Energy content (annual)												Total = Sum(45)m = 1206.8955 (45)
Distribution loss (46)m = 0.15 x (45)m	18.7694	16.4158	16.9397	14.7684	14.1706	12.2282	11.3312	13.0027	13.1580	15.3344	16.7387	18.1771 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0100	12.6388	13.9686	13.4904	13.9200	13.4479	13.8817	13.9066	13.4711	13.9485	13.5306	14.0020	(61)
Total heat required for water heating calculated for each month	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(64)
Heat gains from water heating, kWh/month	45.1080	39.5481	41.0417	36.1092	34.8916	30.4678	28.5879	32.2994	32.5347	37.4784	40.4868	43.7932	(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	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	107.3854	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	35.8918	31.8788	25.9256	19.6273	14.6716	12.3864	13.3840	17.3970	23.3502	29.6484	34.6041	36.8893	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.8381	235.2542	229.1657	216.2038	199.8418	184.4638	174.1904	171.7743	177.8628	190.8247	207.1867	222.5647	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	47.5283	(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)	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	-71.5903	(71)
Water heating gains (Table 5)	60.6290	58.8514	55.1636	50.1517	46.8973	42.3164	38.4247	43.4131	45.1871	50.3742	56.2316	58.8618	(72)
Total internal gains	415.6823	412.3078	396.5783	372.3063	347.7342	325.4900	312.3224	318.9078	332.7236	357.1707	384.3458	404.6392	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
North			7.9500	12.7500	0.7200	0.7000	0.7700	35.4030 (74)				
West			1.0800	23.7835	0.7200	0.7000	0.7700	8.9715 (80)				
Solar gains	44.3745	75.0334	126.9092	204.0027	263.0535	295.2350	273.9965	225.0416	161.9919	96.1627	54.1650	37.0237 (83)
Total gains	460.0568	487.3412	523.4875	576.3089	610.7877	620.7250	586.3190	543.9494	494.7154	453.3334	438.5108	441.6629 (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	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	71.3748	
alpha	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	5.7583	
util living area	0.9853	0.9773	0.9484	0.8597	0.6749	0.4493	0.3010	0.3432	0.6306	0.8894	0.9711	0.9879	(86)
MIT	20.3039	20.4024	20.6090	20.8337	20.9657	20.9971	20.9998	20.9995	20.9818	20.8265	20.5278	20.2730	(87)
Th 2	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	20.1059	(88)
util rest of house	0.9809	0.9705	0.9331	0.8233	0.6127	0.3762	0.2219	0.2583	0.5484	0.8509	0.9611	0.9842	(89)
MIT 2	19.2047	19.3455	19.6356	19.9303	20.0783	20.1045	20.1059	20.1058	20.0945	19.9291	19.5263	19.1605	(90)
Living area fraction	19.6392	19.7632	20.0204	20.2874	20.4291	20.4573	20.4592	20.4591	20.4452	20.2839	19.9222	19.6003	(91)
MIT	19.6392	19.7632	20.0204	20.2874	20.4291	20.4573	20.4592	20.4591	20.4452	20.2839	19.9222	19.6003	(92)
Temperature adjustment	19.4892	19.6132	19.8704	20.1374	20.2791	20.3073	20.3092	20.3091	20.2952	20.1339	19.7722	19.4503	(93)
adjusted MIT	19.4892	19.6132	19.8704	20.1374	20.2791	20.3073	20.3092	20.3091	20.2952	20.1339	19.7722	19.4503	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9770	0.9659	0.9283	0.8247	0.6252	0.3927	0.2399	0.2776	0.5664	0.8523	0.9564	0.9806	(94)
Useful gains	449.4787	470.7170	485.9719	475.3022	381.8756	243.7875	140.6781	151.0186	280.1909	386.3708	419.4040	433.1072	(95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W	757.7089	732.9893	652.8587	542.0809	393.6288	244.4818	140.7069	151.0869	285.4020	453.6039	621.7908	755.6860	(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	229.3233	176.2470	124.1638	48.0807	8.7444	0.0000	0.0000	0.0000	0.0000	50.0215	145.7185	239.9986	(98)
Space heating												1022.2978	(98)
Space heating per m2												(98) / (4) =	19.1513 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1129.6108 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	229.3233	176.2470	124.1638	48.0807	8.7444	0.0000	0.0000	0.0000	0.0000	50.0215	145.7185	239.9986	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	253.3959	194.7480	137.1976	53.1279	9.6623	0.0000	0.0000	0.0000	0.0000	55.2723	161.0149	265.1919	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	139.1392	122.0777	126.8997	111.9465	108.3910	94.9691	89.4231	100.5914	101.1912	116.1779	125.1219	135.1830	(64)
Efficiency of water heater (217)m	89.2644	89.1626	88.8538	88.2374	87.5311	87.3000	87.3000	87.3000	87.3000	88.2391	88.9930	87.3000	(216)
Fuel for water heating, kWh/month	155.8731	136.9158	142.8186	126.8696	123.8314	108.7848	102.4320	115.2250	115.9120	131.6627	140.5975	151.3463	(219)
Water heating fuel used													1552.2687 (219)
Annual totals kWh/year													
Space heating fuel - main system													1129.6108 (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)													253.5440 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.16 * 1044 * 1.00) =													-133.5736 (233)
Total delivered energy for all uses													2876.8500 (238)

10a. Fuel costs - using BEDF prices (429)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1129.6108	3.9400	44.5067 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1552.2687	3.9400	61.1594 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	253.5440	16.5500	41.9615 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	0.0000	0.0000 (252)
Total energy cost			247.0401 (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	1129.6108	0.2160	243.9959 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1552.2687	0.2160	335.2900 (264)
Space and water heating			579.2860 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	253.5440	0.5190	131.5894 (268)
Energy saving/generation technologies			
PV Unit	-133.5736	0.5190	-69.3247 (269)
Total kg/year			680.4756 (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	1129.6108	1.2200	1378.1252 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1552.2687	1.2200	1893.7678 (264)
Space and water heating			3271.8931 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	253.5440	3.0700	778.3802 (268)
Energy saving/generation technologies			
PV Unit	-133.5736	3.0700	-410.0711 (269)
Primary energy kWh/year			3870.4522 (272)
Primary energy kWh/m2/year			72.5075 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 84
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
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 84
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 429 TEST (25 Jun 2018)
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	£54	£54	£0
Mains gas	£193	£193	£0
Space heating	£144	£144	£0
Water heating	£61	£61	£0
Lighting	£42	£42	£0
Total cost of fuels	£247	£247	£0
Total cost of uses	£247	£247	£0
Delivered energy	54 kWh/m²	54 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	13 kg/m²	13 kg/m²	0 kg/m²
Primary energy	73 kWh/m²	73 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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 Yes
 SAP Region Thames Valley
 Front of dwelling faces South
 Overshading Average or unknown
 Thermal mass parameter 250.0
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 126.83 (P1)
 Transmission heat loss coefficient 30.80 (37)
 Summer heat loss coefficient 157.63 (P2)

Overhangs Orientation	Ratio	Z_overhangs	Overhang type
North	0.000	1.000	None
West	0.000	1.000	None

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (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
North	7.9500	81.1852	0.7200	0.7000	0.9000	263.4871
West	1.0800	117.5071	0.7200	0.7000	0.9000	51.8088
total:						315.2959

	Jun	Jul	Aug	
Solar gains	340	315	260	(P3)
Internal gains	322	309	316	
Total summer gains	663	625	576	(P5)

	4.20	3.96	3.65	
Summer gain/loss ratio	4.20	3.96	3.65	(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	20.45	22.11	21.70	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium

Southern Energy Consultants
Energy & Sustainability Solutions

Surveyor	Stephen Smith, Tel: 01635 261582	Surveyor ID	d168-0001
Client	Bellway Homes Thames Valley		

SAP2012 Input Data (Flat)	09/08/2018
FullRefNo:	001
Regs Region:	England
SAP Region:	Thames Valley
Postcode:	RG30
DwellingOrientation:	West
Property Type:	Flat, Semi-Detached
Storeys:	1
Date Built:	2018
Sheltered Sides:	2
Sunlight Shade:	Average or unknown
Measurements	Perimeter, Floor Area, Storey Height
1st Storey:	16.89, 72.19, 2.4
Living Area:	23.49 m2, fraction: 32.5%
Thermal Mass:	Simple calculation
Thermal Mass Simple:	Medium
Thermal MassValue:	250
External Walls	Nett Area, Gross Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
External Wall 1	25.78, 40.54, 0, Other, Cavity, 0, 0.2, Calculate
Party Walls	Area, Kappa, Element, Construction, Type, ShelterFactor, UValueFinal
Party Wall 1	16.32, 0, Other, FilledWithEdge, 0, 0
External Roofs	Nett Area, Gross Area, Kappa, Construction, Element, UValueFinal
Party Ceilings	Area, Kappa, Construction, Element
Party Ceilings 1	72.19, 0, Other
Heat Loss Floors	Area, Kappa, Construction, Element, Type, ShelterFactor, UValueFinal
Party Floors	Area, Kappa, Construction, Element
Party Floor 1	72.19, 0
Description	Data Source, Type, Glazing, Glazing Gap, Argon Filled, Solar Trans, Frame Type, Frame Factor, U Value
Opening Type 1	Manufacturer, Solid Door, , , , , ,
Opening Type 2	Manufacturer, Window, Double Low-E Hard 0.15, , , 0.72, , 0.7,
Openings	Opening Type, Location, Orientation, Pitch, Curtain Type, Overhang Ratio, Wide Overhang, Width, Height, Count, Area, Curtain Closed
Opening 1	Solid Door, External Wall 1, West, , , , 0, 0, 0, 1.95,
Opening 2	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 1.44,
Opening 3	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 1.26,
Opening 4	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 5.25,
Opening 5	Window, External Wall 1, North, , None, 0, , 0, 0, 0, 1.08,
Opening 6	Window, External Wall 1, East, , None, 0, , 0, 0, 0, 3.78,
Conservatory:	None
Draught Proofing:	100
Draught Lobby:	No
Thermal Bridges	
Bridging:	Calculate Bridges
Y	0.159
List of Bridges	Junction with, Bridge Type, Source Type, Imported, Length, Psi, Adjusted, Result, Reference
0.	External wall, E1 Steel lintel with perforated steel base plate, , No, 0, 0, 0, 0.00,
1.	External wall, E2 Other lintels (including other steel lintels), Table K1 - Approved, Yes, 8.53, 0.3, 0.3, 2.56, ACD
2.	External wall, E3 Sill, Independently assessed, Yes, 7.6, 0.045, 0.045, 0.34, CD0027
3.	External wall, E4 Jamb, Independently assessed, Yes, 19.5, 0.051, 0.051, 0.99, CD0028
4.	External wall, E5 Ground floor (normal), , No, 0, 0, 0, 0.00,
5.	External wall, E19 Ground floor (inverted), , No, 0, 0, 0, 0.00,
6.	External wall, E20 Exposed floor (normal), , No, 0, 0, 0, 0.00,
7.	External wall, E21 Exposed floor (inverted), , No, 0, 0, 0, 0.00,
8.	External wall, E22 Basement floor, , No, 0, 0, 0, 0.00,
9.	External wall, E6 Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
10.	External wall, E7 Party floor between dwellings (in blocks of flats), Independently assessed, No, 33.78, 0.058, 0.058, 1.96, CD0030
11.	External wall, E8 Balcony within a dwelling, wall insulation continuous, , No, 0, 0, 0, 0.00,
12.	External wall, E9 Balcony between dwellings, wall insulation continuous, , No, 0, 0, 0, 0.00,
13.	External wall, E23 Balcony within or between dwellings, balcony support penetrates wall insulation, , No, 0, 0, 0, 0.00,
14.	External wall, E10 Eaves (insulation at ceiling level), , No, 0, 0, 0, 0.00,
15.	External wall, E24 Eaves (insulation at ceiling level - inverted), , No, 0, 0, 0, 0.00,
16.	External wall, E11 Eaves (insulation at rafter level), , No, 0, 0, 0, 0.00,
17.	External wall, E12 Gable (insulation at ceiling level), , No, 0, 0, 0, 0.00,
18.	External wall, E13 Gable (insulation at rafter level), , No, 0, 0, 0, 0.00,
19.	External wall, E14 Flat roof, , No, 0, 0, 0, 0.00,
20.	External wall, E15 Flat roof with parapet, , No, 0, 0, 0, 0.00,
21.	External wall, E16 Corner (normal), Independently assessed, Yes, 4.8, 0.057, 0.057, 0.27, CD0035
22.	External wall, E17 Corner (inverted - internal area greater than external area), , No, 0, 0, 0, 0.00,
23.	External wall, E18 Party wall between dwellings, Independently assessed, Yes, 4.8, 0.062, 0.062, 0.30, CD0037
24.	External wall, E25 Staggered party wall between dwellings, , No, 0, 0, 0, 0.00,
25.	Party wall, P1 Party wall - Ground floor, , No, 0, 0, 0, 0.00,
26.	Party wall, P6 Party wall - Ground floor (inverted), , No, 0, 0, 0, 0.00,
27.	Party wall, P2 Party wall - Intermediate floor within a dwelling, , No, 0, 0, 0, 0.00,
28.	Party wall, P3 Party wall - Intermediate floor between dwellings (in blocks of flats), Table K1 - Default, No, 13.6, 0, 0, 0.00,
Default	
29.	Party wall, P7 Party Wall - Exposed floor (normal), , No, 0, 0, 0, 0.00,
30.	Party wall, P8 Party Wall - Exposed floor (inverted), , No, 0, 0, 0, 0.00,
31.	Party wall, P4 Party wall - Roof (insulation at ceiling level), , No, 0, 0, 0, 0.00,
32.	Party wall, P5 Party wall - Roof (insulation at rafter level), , No, 0, 0, 0, 0.00,

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



SAP2012 - 9.92 input data (DesignData) -

33.	External roof, R1 Head of roof window, , No, 0, 0, 0, 0.00,
34.	External roof, R2 Sill of roof window, , No, 0, 0, 0, 0.00,
35.	External roof, R3 Jamb of roof window, , No, 0, 0, 0, 0.00,
36.	External roof, R4 Ridge (vaulted ceiling), , No, 0, 0, 0, 0.00,
37.	External roof, R5 Ridge (inverted), , No, 0, 0, 0, 0.00,
38.	External roof, R6 Flat ceiling, , No, 0, 0, 0, 0.00,
39.	External roof, R7 Flat ceiling (inverted), , No, 0, 0, 0, 0.00,
40.	External roof, R8 Roof to wall (rafter), , No, 0, 0, 0, 0.00,
41.	External roof, R9 Roof to wall (flat ceiling), , No, 0, 0, 0, 0.00,
Pressure Test:	True
Designed q50:	5
AsBuilt q50:	15
Property Tested:	False
Mechanical Ventilation	
MV System Present	Yes
Windows In Hot Weather	Windows half open
Cross Ventilation	Yes
Night Ventilation	Yes
Air Change Rate	3.00
Approved Installation	Yes
DataType	Database
Type	Mechanical extract ventilation - centralised
Database Ref Number	500295
Configuration	0
ManufacturerSFP	0
DuctType	Rigid
Wet Rooms	3
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:	0
Passive Vents:	0
Flueless Gas Fires:	0
Cooling System	None
Light Fittings:	12
LEL Fittings:	12
Percentage of LEL Fittings:	100
External Lights Fitted:	No
External LELs Fitted:	No
Electricity Tariff:	Standard
Main Heating 1	
Description	
Percentage	100
Sedbuk ID	17929
Fuel Type	Mains gas
MHS	Mains gas BGW Post 98 Combi condens. with auto ign.
SAP Code	104
Boiler Efficiency Type	Split Efficiencies
Efficiency Winter	90.5
Efficiency Summer	87.3
Controls by PCDF	0
MHS Controls	CBI Time and temperature zone control
Boiler Interlock	Yes
Compensator	0
Delayed Start Stat	Yes
Ctrl SAP Code	2110
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)
Combi boiler type	Standard Combi
Combi keep hot type	None
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	None
Flue Gas Heat Recovery System	None
Waste Water Heat Recovery	none
PV Unit	
Type	One Dwelling
PVUnit 1	Cells Peak = 0.1, Orientation = Horizontal, Elevation = Horizontal, Overshading = None Or Little, , Connected to Dwelling = No
Wind Turbine	None
Terrain Type:	Urban
Small Scale Hydro	None
Special Features	None

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

DWELLING AS DESIGNED

Mid-floor flat, total floor area 72 m²

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

SAP2012 - 9.92 input data (DesignData) -

1a TER and DER			
Fuel for main heating:Mains gas			
Fuel factor:1.00 (mains gas)			
Target Carbon Dioxide Emission Rate (TER) 15.30 kgCO ₂ /m ²			
Dwelling Carbon Dioxide Emission Rate (DER) 12.36 kgCO ₂ /m ² OK			
1b TFEE and DFEE			
Target Fabric Energy Efficiency (TFEE)34.0 kWh/m ² /yr			
Dwelling Fabric Energy Efficiency (DFEE)29.5 kWh/m ² /yrOK			
2 Fabric U-values			
Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.26 (max. 2.00)	1.30 (max. 3.30)	OK
2a Thermal bridging			
Thermal bridging calculated from linear thermal transmittances for each junction			
3 Air permeability			
Air permeability at 50 pascals:			
Maximum	5.00 (design value)	10.0	OK
4 Heating efficiency			
Main heating system:			
Boiler system with radiators or underfloor - Mains gas			
Data from database			
Ideal LOGIC COMBI ESPI 35			
Combi boiler			
Efficiency: 89.6% SEDBUK2009			
Minimum: 88.0%			
Secondary heating system:			
None			
5 Cylinder insulation			
Hot water storage			
No cylinder			
6 Controls			
Space heating controls:			
Time and temperature zone control			
Hot water controls:			
No cylinder			
Boiler interlock			
Yes			
7 Low energy lights			
Percentage of fixed lights with low-energy fittings:100%			
Minimum			
75%			
8 Mechanical ventilation			
Continuous extract system			
Specific fan power:			
0.00			
Maximum			
0.7			
9 Summertime temperature			
Overheating risk (Thames Valley):			
Medium			
Based on:			
Overshading:			
Average			
Windows facing North:			
1.08 m ² , No overhang			
Windows facing East:			
11.73 m ² , No overhang			
Air change rate:			
3.00 ach			
Blinds/curtains:			
None			
10 Key features			
Party wall U-value			
0.00 W/m ² K			
Door U-value			
1.00 W/m ² K			
Photovoltaic array			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design q50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.2500 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			12.8100	1.2357	15.8298		(27)
External Wall 1	40.5400	14.7600	25.7800	0.2000	5.1560		(29a)
Total net area of external elements Aum(A, m ²)			40.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.9358		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			72.1900				(32d)
Party Ceilings 1			72.1900				(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.4259 (36)
Total fabric heat loss	(33) + (36) = 29.3618 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.7843	Feb 29.4806	Mar 29.1769	Apr 28.5872	May 28.5872	Jun 28.5872	Jul 28.5872	Aug 28.5872	Sep 28.5872	Oct 28.5872	Nov 28.5872	Dec 28.5872 (38)
Heat transfer coeff	59.1461	58.8424	58.5386	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490 (39)
Average = Sum(39)m / 12 =												58.1724 (39)

HLP	Jan 0.8193	Feb 0.8151	Mar 0.8109	Apr 0.8027	May 0.8027	Jun 0.8027	Jul 0.8027	Aug 0.8027	Sep 0.8027	Oct 0.8027	Nov 0.8027	Dec 0.8027 (40)
HLP (average)												0.8058 (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	2.2981 (42)
Average daily hot water use (litres/day)	88.7798 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)										Total = Sum(45)m =		1396.8521 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7236	18.9996	19.6058	17.0928	16.4010	14.1528	13.1147	15.0493	15.2290	17.7479	19.3733	21.0381 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0960	12.7114	14.0406	13.5507	13.9756	13.4937	13.9242	13.9575	13.5248	14.0137	13.6045	14.0853 (61)
Total heat required for water heating calculated for each month	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393 (64)
Heat gains from water heating, kWh/month	51.6779	45.2935	46.9698	41.2768	39.8494	34.7455	32.5519	36.8486	37.1388	42.8447	46.3452	50.1558 (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	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4680	16.4031	13.3399	10.0992	7.5493	6.3734	6.8867	8.9516	12.0148	15.2555	17.8055	18.9813	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.3534	204.4532	199.1618	187.8970	173.6772	160.3126	151.3843	149.2845	154.5759	165.8407	180.0605	193.4251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	69.4595	67.4011	63.1314	57.3289	53.5611	48.2576	43.7525	49.5277	51.5817	57.5869	64.3683	67.4137	(72)
Total internal gains	350.7524	348.7289	336.1046	315.7966	295.2590	275.4151	262.4949	268.2352	278.6438	299.1546	322.7057	340.2915	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					1.0800	10.6334		0.7200	0.7000	0.7700		4.0111 (74)
East					11.7300	19.6403		0.7200	0.7000	0.7700		80.4654 (76)
Solar gains	84.4764	165.0727	272.2528	398.9898	491.5202	504.4788	479.7288	410.2317	317.1529	195.9017	105.2790	69.5146 (83)
Total gains	435.2289	513.8016	608.3574	714.7864	786.7792	779.8939	742.2238	678.4669	595.7968	495.0563	427.9847	409.8062 (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	84.7595	85.1970	85.6391	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	
alpha	6.6506	6.6798	6.7093	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	
util living area	0.9976	0.9922	0.9672	0.8627	0.6674	0.4739	0.3434	0.3925	0.6556	0.9398	0.9935	0.9983	(86)
MIT	20.2337	20.3938	20.6389	20.8826	20.9808	20.9982	20.9998	20.9996	20.9871	20.8091	20.4718	20.2161	(87)
Th 2	20.2366	20.2403	20.2439	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	(88)
util rest of house	0.9968	0.9899	0.9577	0.8323	0.6193	0.4192	0.2850	0.3288	0.5907	0.9178	0.9911	0.9978	(89)
MIT 2	19.2051	19.4406	19.7932	20.1231	20.2342	20.2499	20.2509	20.2508	20.2418	20.0376	19.5636	19.1907	(90)
Living area fraction									fLA = Living area / (4) =			0.3254	(91)
MIT	19.5398	19.7508	20.0684	20.3703	20.4771	20.4934	20.4946	20.4945	20.4843	20.2887	19.8591	19.5244	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.3898	19.6008	19.9184	20.2203	20.3271	20.3434	20.3446	20.3445	20.3343	20.1387	19.7091	19.3744	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	433.3418	507.2527	579.6548	593.9646	491.2038	332.2232	216.9586	228.4811	356.3565	452.4568	423.1597	408.5550	(94)
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	892.5039	865.0291	785.4944	655.9985	499.9325	332.8236	216.9959	228.5773	361.2728	552.7564	730.6867	879.3414	(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	341.6166	240.4258	153.1446	44.6644	6.4942	0.0000	0.0000	0.0000	0.0000	74.6229	221.4194	350.2651	(98)
Space heating												1432.6530	(98)
Space heating per m2										(98) / (4) =		19.8456	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1583.0420 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	341.6166	240.4258	153.1446	44.6644	6.4942	0.0000	0.0000	0.0000	0.0000	74.6229	221.4194	350.2651	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	377.4769	265.6638	169.2206	49.3529	7.1759	0.0000	0.0000	0.0000	0.0000	82.4562	244.6624	387.0333	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(64)
Efficiency of water heater (217)m	89.4589	89.2988	88.9163	88.1082	87.4547	87.3000	87.3000	87.3000	87.3000	88.4274	89.2180	87.3000	(216)
Fuel for water heating, kWh/month	177.6455	156.0772	162.7893	144.7119	141.0050	123.5347	116.1000	130.9117	131.7886	149.6518	160.0120	172.4526	(219)
Water heating fuel used												1766.6803	(219)
Annual totals kWh/year													
Space heating fuel - main system												1583.0420	(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)													326.1512 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.10 * 951 * 1.00) =													-76.0493 (233)
Total delivered energy for all uses													3674.8243 (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	1583.0420	0.2160	341.9371 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1766.6803	0.2160	381.6030 (264)
Space and water heating			723.5400 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.1512	0.5190	169.2725 (268)
Energy saving/generation technologies			
PV Unit	-76.0493	0.5190	-39.4696 (269)
Total CO2, kg/year			892.2679 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.3600 (273)

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

DER			12.3600 ZC1
Total Floor Area		TFA	72.1900
Assumed number of occupants		N	2.2981
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6104 ZC2
CO2 emissions from cooking, equation (L16)			2.4124 ZC3
Total CO2 emissions			31.3828 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			31.3828 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1732 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.4232 (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) =		0.3597 (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												
	0.4586	0.4496	0.4406	0.3956	0.3867	0.3417	0.3417	0.3327	0.3597	0.3867	0.4046	0.4226 (22b)
Effective ac	0.6052	0.6011	0.5971	0.5783	0.5748	0.5584	0.5584	0.5553	0.5647	0.5748	0.5819	0.5893 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9500	1.0000	1.9500		(26)					
TER Opening Type (Uw = 1.40)			12.8100	1.3258	16.9830		(27)					
External Wall 1	40.5400	14.7600	25.7800	0.1800	4.6404		(29a)					
Total net area of external elements Aum(A, m2)			40.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			23.5734	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8661 (36)					
Total fabric heat loss						(33) + (36) =	28.4395 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.5994	Feb 34.3659	Mar 34.1371	Apr 33.0622	May 32.8611	Jun 31.9250	Jul 31.9250	Aug 31.7516	Sep 32.2856	Oct 32.8611	Nov 33.2680	Dec 33.6933 (38)
Heat transfer coeff	63.0388	62.8054	62.5765	61.5017	61.3006	60.3645	60.3645	60.1911	60.7250	61.3006	61.7074	62.1327 (39)
Average = Sum(39)m / 12 =												61.5007 (39)
HLP	Jan 0.8732	Feb 0.8700	Mar 0.8668	Apr 0.8519	May 0.8492	Jun 0.8362	Jul 0.8362	Aug 0.8338	Sep 0.8412	Oct 0.8492	Nov 0.8548	Dec 0.8607 (40)
HLP (average)												0.8519 (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												2.2981 (42)
Average daily hot water use (litres/day)												88.7798 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)										Total = Sum(45)m =		1396.8521 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7236	18.9996	19.6058	17.0928	16.4010	14.1528	13.1147	15.0493	15.2290	17.7479	19.3733	21.0381 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.7653	43.3148	46.1460	42.9062	42.5267	39.4036	40.7171	42.5267	42.9062	46.1460	46.4087	49.7653 (61)
Total heat required for water heating calculated for each month												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Solar input	194.5890	169.9785	176.8516	156.8585	151.8667	133.7557	128.1482	142.8552	144.4328	164.4656	175.5638	190.0193 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	194.5890	169.9785	176.8516	156.8585	151.8667	133.7557	128.1482	142.8552	144.4328	164.4656	175.5638	190.0193 (64)
Heat gains from water heating, kWh/month	60.5952	52.9444	54.9961	48.6157	46.9872	41.2230	39.2501	43.9909	44.4842	50.8778	54.5462	59.0758 (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	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4680	16.4031	13.3399	10.0992	7.5493	6.3734	6.8867	8.9516	12.0148	15.2555	17.8055	18.9813 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.3534	204.4532	199.1618	187.8970	173.6772	160.3126	151.3843	149.2845	154.5759	165.8407	180.0605	193.4251 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905 (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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239 (71)
Water heating gains (Table 5)	81.4452	78.7863	73.9195	67.5218	63.1549	57.2541	52.7555	59.1275	61.7836	68.3841	75.7587	79.4029 (72)
Total internal gains	362.7381	360.1141	346.8927	325.9895	304.8528	284.4116	271.4979	277.8350	288.8457	309.9518	334.0960	352.2808 (73)

6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
North					1.0800	10.6334	0.6300	0.7000			0.7700	3.5097 (74)
East					11.7300	19.6403	0.6300	0.7000			0.7700	70.4072 (76)

Solar gains	73.9169	144.4386	238.2212	349.1161	430.0801	441.4190	419.7627	358.9528	277.5088	171.4140	92.1192	60.8253 (83)
Total gains	436.6550	504.5528	585.1139	675.1056	734.9330	725.8306	691.2607	636.7878	566.3545	481.3657	426.2152	413.1061 (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	79.5255	79.8211	80.1130	81.5131	81.7805	83.0488	83.0488	83.2880	82.5556	81.7805	81.2414	80.6853
alpha	6.3017	6.3214	6.3409	6.4342	6.4520	6.5366	6.5366	6.5525	6.5037	6.4520	6.4161	6.3790
util living area	0.9977	0.9938	0.9771	0.9037	0.7359	0.5282	0.3838	0.4338	0.7096	0.9544	0.9943	0.9984 (86)
MIT	20.1546	20.3012	20.5396	20.8156	20.9598	20.9959	20.9996	20.9991	20.9764	20.7549	20.4034	20.1329 (87)
Th 2	20.1903	20.1931	20.1958	20.2085	20.2109	20.2221	20.2221	20.2241	20.2178	20.2109	20.2061	20.2010 (88)
util rest of house	0.9970	0.9918	0.9700	0.8780	0.6854	0.4658	0.3162	0.3612	0.6408	0.9362	0.9922	0.9978 (89)
MIT 2	19.0538	19.2693	19.6142	20.0015	20.1747	20.2195	20.2219	20.2238	20.2004	19.9317	19.4291	19.0304 (90)
Living area fraction									fLA = Living area / (4) =			0.3254 (91)
MIT	19.4120	19.6051	19.9153	20.2664	20.4301	20.4722	20.4750	20.4760	20.4529	20.1995	19.7461	19.3892 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4120	19.6051	19.9153	20.2664	20.4301	20.4722	20.4750	20.4760	20.4529	20.1995	19.7461	19.3892 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9960	0.9899	0.9669	0.8801	0.7000	0.4860	0.3382	0.3848	0.6622	0.9358	0.9905	0.9971 (94)
Useful gains	434.9158	499.4811	565.7742	594.1512	514.4212	352.7874	233.7797	245.0503	375.0534	450.4860	422.1773	411.9087 (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	952.6430	923.5589	839.4827	699.0541	535.1617	354.4699	233.9096	245.3417	385.7807	588.4576	780.3583	943.7443 (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	385.1890	284.9803	203.6391	75.5301	15.4309	0.0000	0.0000	0.0000	0.0000	102.6509	257.8903	395.6857 (98)
Space heating												1720.9964 (98)
Space heating per m ²										(98) / (4) =		23.8398 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1842.6086 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	385.1890	284.9803	203.6391	75.5301	15.4309	0.0000	0.0000	0.0000	0.0000	102.6509	257.8903	395.6857	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	412.4079	305.1181	218.0291	80.8674	16.5214	0.0000	0.0000	0.0000	0.0000	109.9046	276.1138	423.6464	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	194.5890	169.9785	176.8516	156.8585	151.8667	133.7557	128.1482	142.8552	144.4328	164.4656	175.5638	190.0193	(64)
Efficiency of water heater	86.7384	86.3426	85.4070	83.3258	81.1361	80.3000	80.3000	80.3000	80.3000	83.9024	86.0179	86.8558	(216)
Fuel for water heating, kWh/month	224.3402	196.8653	207.0693	188.2473	187.1752	166.5700	159.5867	177.9018	179.8666	196.0202	204.1015	218.7757	(219)
Water heating fuel used												2306.5198	(219)
Annual totals kWh/year													
Space heating fuel - main system												1842.6086	(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)												326.1512	(232)
Total delivered energy for all uses												4550.2797	(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	1842.6086	0.2160	398.0035 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2306.5198	0.2160	498.2083 (264)
Space and water heating			896.2117 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.1512	0.5190	169.2725 (268)
Total CO2, kg/m2/year			1104.4092 (272)
Emissions per m2 for space and water heating			12.4146 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3448 (272b)
Emissions per m2 for pumps and fans			0.5392 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.4146 * 1.00) + 2.3448 + 0.5392, rounded to 2 d.p.			15.3000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1732 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.4232 (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) = 0.3597 (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												
Effective ac	0.4586	0.4496	0.4406	0.3956	0.3867	0.3417	0.3417	0.3327	0.3597	0.3867	0.4046	0.4226 (22b)
Effective ac	0.6052	0.6011	0.5971	0.5783	0.5748	0.5584	0.5584	0.5553	0.5647	0.5748	0.5819	0.5893 (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					
Opening Type 1			1.9500	1.0000	1.9500		(26)					
Opening Type 2 (Uw = 1.30)			12.8100	1.2357	15.8298		(27)					
External Wall 1	40.5400	14.7600	25.7800	0.2000	5.1560		(29a)					
Total net area of external elements Aum(A, m2)			40.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	22.9358		(33)					
Party Wall 1			16.3200	0.0000	0.0000		(32)					
Party Floor 1			72.1900				(32d)					
Party Ceilings 1			72.1900				(32b)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4259 (36)					
Total fabric heat loss						(33) + (36) =	29.3618 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.5994	Feb 34.3659	Mar 34.1371	Apr 33.0622	May 32.8611	Jun 31.9250	Jul 31.9250	Aug 31.7516	Sep 32.2856	Oct 32.8611	Nov 33.2680	Dec 33.6933 (38)
Heat transfer coeff	63.9611	63.7277	63.4989	62.4240	62.2229	61.2868	61.2868	61.1134	61.6474	62.2229	62.6297	63.0551 (39)
Average = Sum(39)m / 12 =												62.4231 (39)
HLP	Jan 0.8860	Feb 0.8828	Mar 0.8796	Apr 0.8647	May 0.8619	Jun 0.8490	Jul 0.8490	Aug 0.8466	Sep 0.8540	Oct 0.8619	Nov 0.8676	Dec 0.8735 (40)
HLP (average)												0.8647 (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												2.2981 (42)
Average daily hot water use (litres/day)												88.7798 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)										Total = Sum(45)m =		1396.8521 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	30.7750	26.9160	27.7749	24.2149	23.2347	20.0498	18.5791	21.3198	21.5744	25.1429	27.4454	29.8040 (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	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4680	16.4031	13.3399	10.0992	7.5493	6.3734	6.8867	8.9516	12.0148	15.2555	17.8055	18.9813	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.3534	204.4532	199.1618	187.8970	173.6772	160.3126	151.3843	149.2845	154.5759	165.8407	180.0605	193.4251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	41.3643	40.0536	37.3319	33.6318	31.2295	27.8470	24.9719	28.6556	29.9645	33.7942	38.1187	40.0591	(72)
Total internal gains	319.6572	318.3815	307.3051	289.0994	269.9274	252.0045	240.7143	244.3631	254.0266	272.3619	293.4561	309.9370	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North					1.0800	10.6334	0.7200		0.7000		0.7700		4.0111 (74)	
East					11.7300	19.6403	0.7200		0.7000		0.7700		80.4654 (76)	
Solar gains	84.4764	165.0727	272.2528	398.9898	491.5202	504.4788	479.7288	410.2317	317.1529	195.9017	105.2790	69.5146 (83)		
Total gains	404.1337	483.4542	579.5579	688.0893	761.4476	756.4833	720.4432	654.5949	571.1795	468.2636	398.7351	379.4516 (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	78.3787	78.6659	78.9494	80.3087	80.5683	81.7989	81.7989	82.0310	81.3205	80.5683	80.0449	79.5050	
alpha	6.2252	6.2444	6.2633	6.3539	6.3712	6.4533	6.4533	6.4687	6.4214	6.3712	6.3363	6.3003	
util living area	0.9985	0.9952	0.9789	0.9008	0.7234	0.5149	0.3739	0.4284	0.7125	0.9612	0.9961	0.9990	(86)
MIT	20.0917	20.2548	20.5164	20.8141	20.9618	20.9962	20.9996	20.9991	20.9747	20.7295	20.3508	20.0681	(87)
Th 2	20.1794	20.1822	20.1849	20.1976	20.2000	20.2111	20.2111	20.2132	20.2068	20.2000	20.1952	20.1901	(88)
util rest of house	0.9981	0.9936	0.9722	0.8744	0.6723	0.4531	0.3071	0.3557	0.6429	0.9451	0.9946	0.9987	(89)
MIT 2	19.3426	19.5073	19.7668	20.0555	20.1766	20.2095	20.2110	20.2129	20.1941	19.9874	19.6143	19.3280	(90)
Living area fraction	19.5863	19.7505	20.0107	20.3023	20.4321	20.4655	20.4676	20.4687	fLA = Living area / (4) =	20.4481	20.2289	19.8539	0.3254 (91)
MIT	19.5863	19.7505	20.0107	20.3023	20.4321	20.4655	20.4676	20.4687	20.4481	20.2289	19.8539	19.5688	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5863	19.7505	20.0107	20.3023	20.4321	20.4655	20.4676	20.4687	20.4481	20.2289	19.8539	19.5688	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	403.1630	479.8601	562.4488	604.2736	523.5699	357.9206	236.9106	248.3584	379.7750	442.8591	396.2742	378.8231	(94)
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	977.7313	946.3887	857.9142	711.7782	543.3373	359.4771	237.0325	248.6529	391.3428	599.1383	798.7747	969.0812	(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	427.4788	313.5072	219.8262	77.4033	14.7070	0.0000	0.0000	0.0000	0.0000	116.2717	289.8004	439.1521	(98)
Space heating												1898.1467	(98)
Space heating per m2												26.2938	(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	576.0958	453.5222	464.4620	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9856	0.9949	0.9908	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	567.8070	451.1987	460.2013	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	969.7522	925.9059	850.3875	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	289.4006	353.1822	290.2985	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												932.8814	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

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Intermittency factor (Table 10b)	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	72.3501	88.2956	72.5746	0.0000	0.0000	0.0000 (107)
Space cooling											233.2203 (107)
Space cooling per m2											3.2306 (108)
Energy for space heating											26.2938 (99)
Energy for space cooling											3.2306 (108)
Total											29.5244 (109)
Dwelling Fabric Energy Efficiency (DFEE)											29.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 30.0000 / (5) = 0.1732 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.4232 (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) =	0.3597 (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												
	0.4586	0.4496	0.4406	0.3956	0.3867	0.3417	0.3417	0.3327	0.3597	0.3867	0.4046	0.4226 (22b)
Effective ac	0.6052	0.6011	0.5971	0.5783	0.5748	0.5584	0.5584	0.5553	0.5647	0.5748	0.5819	0.5893 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9500	1.0000	1.9500		(26)					
TER Opening Type (Uw = 1.40)			12.8100	1.3258	16.9830		(27)					
External Wall 1	40.5400	14.7600	25.7800	0.1800	4.6404		(29a)					
Total net area of external elements Aum(A, m2)			40.5400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =			23.5734	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.8661 (36)					
Total fabric heat loss						(33) + (36) =	28.4395 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.5994	Feb 34.3659	Mar 34.1371	Apr 33.0622	May 32.8611	Jun 31.9250	Jul 31.9250	Aug 31.7516	Sep 32.2856	Oct 32.8611	Nov 33.2680	Dec 33.6933 (38)
Heat transfer coeff	63.0388	62.8054	62.5765	61.5017	61.3006	60.3645	60.3645	60.1911	60.7250	61.3006	61.7074	62.1327 (39)
Average = Sum(39)m / 12 =												61.5007 (39)
HLP	Jan 0.8732	Feb 0.8700	Mar 0.8668	Apr 0.8519	May 0.8492	Jun 0.8362	Jul 0.8362	Aug 0.8338	Sep 0.8412	Oct 0.8492	Nov 0.8548	Dec 0.8607 (40)
HLP (average)												0.8519 (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												2.2981 (42)
Average daily hot water use (litres/day)												88.7798 (43)
Daily hot water use	Jan 97.6578	Feb 94.1066	Mar 90.5554	Apr 87.0042	May 83.4530	Jun 79.9018	Jul 79.9018	Aug 83.4530	Sep 87.0042	Oct 90.5554	Nov 94.1066	Dec 97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)										Total = Sum(45)m =		1396.8521 (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												

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30.7750 26.9160 27.7749 24.2149 23.2347 20.0498 18.5791 21.3198 21.5744 25.1429 27.4454 29.8040 (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	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	114.9049	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.4680	16.4031	13.3399	10.0992	7.5493	6.3734	6.8867	8.9516	12.0148	15.2555	17.8055	18.9813	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	202.3534	204.4532	199.1618	187.8970	173.6772	160.3126	151.3843	149.2845	154.5759	165.8407	180.0605	193.4251	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	34.4905	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	41.3643	40.0536	37.3319	33.6318	31.2295	27.8470	24.9719	28.6556	29.9645	33.7942	38.1187	40.0591	(72)
Total internal gains	319.6572	318.3815	307.3051	289.0994	269.9274	252.0045	240.7143	244.3631	254.0266	272.3619	293.4561	309.9370	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				1.0800	10.6334	0.6300	0.7000			0.7700			3.5097 (74)
East				11.7300	19.6403	0.6300	0.7000			0.7700			70.4072 (76)

Solar gains	73.9169	144.4386	238.2212	349.1161	430.0801	441.4190	419.7627	358.9528	277.5088	171.4140	92.1192	60.8253 (83)	
Total gains	393.5741	462.8201	545.5263	638.2155	700.0076	693.4234	660.4771	603.3159	531.5354	443.7759	385.5752	370.7623 (84)	

7. Mean internal temperature (heating season)

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

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
tau	79.5255	79.8211	80.1130	81.5131	81.7805	83.0488	83.0488	83.2880	82.5556	81.7805	81.2414	80.6853	
alpha	6.3017	6.3214	6.3409	6.4342	6.4520	6.5366	6.5366	6.5525	6.5037	6.4520	6.4161	6.3790	
util living area	0.9987	0.9961	0.9838	0.9222	0.7631	0.5517	0.4015	0.4574	0.7456	0.9685	0.9967	0.9991	(86)
MIT	20.0962	20.2458	20.4915	20.7859	20.9506	20.9948	20.9994	20.9987	20.9687	20.7141	20.3491	20.0752	(87)
Th 2	20.1903	20.1931	20.1958	20.2085	20.2109	20.2221	20.2221	20.2241	20.2178	20.2109	20.2061	20.2010	(88)
util rest of house	0.9983	0.9948	0.9785	0.8997	0.7132	0.4871	0.3309	0.3811	0.6769	0.9549	0.9955	0.9988	(89)
MIT 2	19.3562	19.5076	19.7524	20.0417	20.1800	20.2198	20.2219	20.2238	20.2017	19.9833	19.6219	19.3443	(90)
Living area fraction									fLA = Living area / (4) =			0.3254	(91)
MIT	19.5970	19.7478	19.9929	20.2838	20.4308	20.4720	20.4749	20.4760	20.4513	20.2211	19.8585	19.5821	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5970	19.7478	19.9929	20.2838	20.4308	20.4720	20.4749	20.4760	20.4513	20.2211	19.8585	19.5821	(93)

8. Space heating requirement

Utilisation	0.9979	0.9940	0.9769	0.9020	0.7277	0.5080	0.3539	0.4060	0.6984	0.9551	0.9947	0.9985	(94)
Useful gains	392.7513	460.0218	532.9144	575.6988	509.4201	352.2892	233.7368	244.9352	371.2391	423.8505	383.5480	370.2215	(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	964.3068	932.5207	844.3390	700.1246	535.2005	354.4595	233.9076	245.3360	385.6812	589.7783	787.2952	955.7334	(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	425.2373	317.5192	231.6999	89.5865	19.1806	0.0000	0.0000	0.0000	0.0000	123.4502	290.6980	435.6208	(98)
Space heating												1932.9927	(98)
Space heating per m ²												26.7765	(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	567.4258	446.6969	457.4523	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9809	0.9931	0.9881	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	556.5770	443.6278	452.0131	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	896.0459	855.8157	790.4510	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	244.4176	306.6678	251.7978	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												802.8832	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	61.1044	76.6669	62.9495	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												200.7208 (107)
Space cooling per m2												2.7805 (108)
Energy for space heating												26.7765 (99)
Energy for space cooling												2.7805 (108)
Total												29.5569 (109)
Target Fabric Energy Efficiency (TFEE)												34.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2338	0.2178	0.2178	0.2072	0.2072	0.1806	0.1806	0.1753	0.1806	0.2019	0.1966	0.2125 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			12.8100	1.2357	15.8298		(27)
External Wall 1	40.5400	14.7600	25.7800	0.2000	5.1560		(29a)
Total net area of external elements Aum(A, m ²)			40.5400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.9358		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			72.1900				(32d)
Party Ceilings 1			72.1900				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4259 (36)
Total fabric heat loss							(33) + (36) = 29.3618 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872 (38)
Heat transfer coeff	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490 (39)
Average = Sum(39)m / 12 =												57.9490 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027 (40)
HLP (average)												0.8027 (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	2.2981 (42)
Average daily hot water use (litres/day)	88.7798 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)												Total = Sum(45)m = 1396.8521 (45)
Distribution loss (46)m = 0.15 x (45)m	21.7236	18.9996	19.6058	17.0928	16.4010	14.1528	13.1147	15.0493	15.2290	17.7479	19.3733	21.0381 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0960	12.7114	14.0406	13.5507	13.9756	13.4937	13.9242	13.9575	13.5248	14.0137	13.6045	14.0853	(61)
Total heat required for water heating calculated for each month	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	51.6779	45.2935	46.9698	41.2768	39.8494	34.7455	32.5519	36.8486	37.1388	42.8447	46.3452	50.1558	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1701	41.0079	33.3498	25.2480	18.8732	15.9335	17.2167	22.3789	30.0370	38.1388	44.5137	47.4533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.0201	305.1541	297.2565	280.4433	259.2198	239.2726	225.9467	222.8126	230.7103	247.5234	268.7470	288.6941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	69.4595	67.4011	63.1314	57.3289	53.5611	48.2576	43.7525	49.5277	51.5817	57.5869	64.3683	67.4137	(72)
Total internal gains	517.6983	513.6116	493.7863	463.0688	431.7026	403.5124	386.9645	394.7679	412.3776	443.2978	477.6776	503.6097	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.0800	12.7500	0.7200	0.7000	0.7700		4.8095 (74)	
East					11.7300	23.7835	0.7200	0.7000	0.7700		97.4400 (76)	
Solar gains	102.2495	174.6105	285.5886	424.0589	508.1721	551.3708	519.2835	453.2511	354.3780	222.3541	125.5445	84.6123 (83)
Total gains	619.9478	688.2221	779.3750	887.1278	939.8746	954.8831	906.2481	848.0190	766.7555	665.6519	603.2221	588.2220 (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	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104		
alpha	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674		
util living area	0.9780	0.9559	0.8792	0.7108	0.5090	0.3276	0.2174	0.2460	0.4671	0.7815	0.9497	0.9832	(86)	
MIT	20.5463	20.6662	20.8490	20.9663	20.9965	20.9998	21.0000	21.0000	20.9984	20.9499	20.7333	20.5075	(87)	
Th 2	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	(88)	
util rest of house	0.9720	0.9448	0.8542	0.6709	0.4642	0.2822	0.1695	0.1948	0.4114	0.7356	0.9350	0.9785	(89)	
MIT 2	19.6672	19.8349	20.0786	20.2180	20.2483	20.2509	20.2510	20.2510	20.2500	20.2037	19.9306	19.6123	(90)	
Living area fraction	19.9532	20.1054	20.3293	20.4615	20.4917	20.4946	20.4947	20.4947	20.4936	20.4465	20.1918	19.9036	(92)	
Temperature adjustment	19.8032	19.9554	20.1793	20.3115	20.3417	20.3446	20.3447	20.3447	20.3436	20.2965	20.0418	19.7536	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9676	0.9397	0.8516	0.6743	0.4696	0.2879	0.1755	0.2012	0.4183	0.7386	0.9302	0.9746	(94)
Ext temp.	599.8595	646.7271	663.7366	598.1540	441.3885	274.9018	159.0513	170.6392	320.7251	491.6352	561.1405	573.2815	(95)
Heat loss rate W	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Month fracti	863.6287	837.6740	746.3427	614.9257	442.8307	274.9447	159.0523	170.6418	321.2435	515.5440	709.4000	860.7509	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating RHI space heating demand	196.2443	128.3164	61.4590	12.0756	1.0730	0.0000	0.0000	0.0000	0.0000	17.7882	106.7468	213.8772	(98)
												738	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour
Pressure test					0.0000 / (5) = 0.0000 (8)
Measured/design q50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.2500 (18)
					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2125 (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	0.2709	0.2656	0.2603	0.2338	0.2284	0.2019	0.2019	0.1966	0.2125	0.2284	0.2391	0.2497 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5209	0.5156	0.5103	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			12.8100	1.2357	15.8298		(27)
External Wall 1	40.5400	14.7600	25.7800	0.2000	5.1560		(29a)
Total net area of external elements Aum(A, m ²)			40.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.9358		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			72.1900				(32d)
Party Ceilings 1			72.1900				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4259 (36)
Total fabric heat loss						(33) + (36) =	29.3618 (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	29.7843	29.4806	29.1769	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872 (38)
Heat transfer coeff	59.1461	58.8424	58.5386	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490 (39)
Average = Sum(39)m / 12 =												58.1724 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8193	0.8151	0.8109	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027 (40)
HLP (average)												0.8058 (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	2.2981 (42)
Average daily hot water use (litres/day)	88.7798 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)										Total = Sum(45)m =		1396.8521 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7236	18.9996	19.6058	17.0928	16.4010	14.1528	13.1147	15.0493	15.2290	17.7479	19.3733	21.0381 (46)
Water storage loss:												

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Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0960	12.7114	14.0406	13.5507	13.9756	13.4937	13.9242	13.9575	13.5248	14.0137	13.6045	14.0853	(61)
Total heat required for water heating calculated for each month	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(64)
Heat gains from water heating, kWh/month	51.6779	45.2935	46.9698	41.2768	39.8494	34.7455	32.5519	36.8486	37.1388	42.8447	46.3452	50.1558	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1701	41.0079	33.3498	25.2480	18.8732	15.9335	17.2167	22.3789	30.0370	38.1388	44.5137	47.4533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.0201	305.1541	297.2565	280.4433	259.2198	239.2726	225.9467	222.8126	230.7103	247.5234	268.7470	288.6941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	69.4595	67.4011	63.1314	57.3289	53.5611	48.2576	43.7525	49.5277	51.5817	57.5869	64.3683	67.4137	(72)
Total internal gains	517.6983	513.6116	493.7863	463.0688	431.7026	403.5124	386.9645	394.7679	412.3776	443.2978	477.6776	503.6097	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.0800	10.6334	0.7200	0.7000			0.7700			4.0111 (74)
East					11.7300	19.6403	0.7200	0.7000			0.7700			80.4654 (76)
Solar gains	84.4764	165.0727	272.2528	398.9898	491.5202	504.4788	479.7288	410.2317	317.1529	195.9017	105.2790	69.5146	(83)	
Total gains	602.1747	678.6844	766.0391	862.0587	923.2227	907.9912	866.6934	804.9996	729.5305	639.1995	582.9566	573.1244	(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	84.7595	85.1970	85.6391	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	
alpha	6.6506	6.6798	6.7093	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	
util living area	0.9851	0.9669	0.9104	0.7664	0.5773	0.4079	0.2941	0.3310	0.5438	0.8442	0.9663	0.9884	(86)
MIT	20.4539	20.5966	20.7900	20.9438	20.9917	20.9993	20.9999	20.9999	20.9957	20.9124	20.6636	20.4347	(87)
Th 2	20.2366	20.2403	20.2439	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	(88)
util rest of house	0.9810	0.9584	0.8906	0.7300	0.5330	0.3604	0.2441	0.2772	0.4866	0.8063	0.9562	0.9852	(89)
MIT 2	19.5233	19.7285	19.9555	20.1930	20.2440	20.2505	20.2509	20.2509	20.2480	20.1618	19.8347	19.5075	(90)
Living area fraction													(91)
MIT	19.8261	20.0110	20.2540	20.4373	20.4873	20.4942	20.4947	20.4946	20.4913	20.4060	20.1044	19.8092	(92)
Temperature adjustment													-0.1500
adjusted MIT	19.6761	19.8610	20.1040	20.2873	20.3373	20.3442	20.3447	20.3446	20.3413	20.2560	19.9544	19.6592	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9534	0.8865	0.7318	0.5382	0.3663	0.2504	0.2839	0.4936	0.8066	0.9514	0.9819	(94)
Useful gains	588.4783	647.0455	679.1255	630.8849	496.8534	332.6323	216.9856	228.5539	360.0909	515.5851	554.6109	562.7533	(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	909.4351	880.3398	796.3618	659.8842	500.5227	332.8694	216.9994	228.5865	361.6782	559.5574	744.9002	895.8443	(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	238.7918	156.7738	87.2238	20.8795	2.7299	0.0000	0.0000	0.0000	0.0000	32.7154	137.0083	247.8197	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 12.7988 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1020.9307 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	238.7918	156.7738	87.2238	20.8795	2.7299	0.0000	0.0000	0.0000	0.0000	32.7154	137.0083	247.8197	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	263.8584	173.2307	96.3799	23.0713	3.0165	0.0000	0.0000	0.0000	0.0000	36.1496	151.3903	273.8339	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(64)
Efficiency of water heater (217)m	89.1936	88.9653	88.4763	87.7365	87.3669	87.3000	87.3000	87.3000	87.3000	87.9162	88.8383	87.3000	(216)
Fuel for water heating, kWh/month	178.1739	156.6623	163.5988	145.3249	141.1467	123.5347	116.1000	130.9117	131.7886	150.5221	160.6959	172.9397	(219)
Water heating fuel used												1771.3993	(219)
Annual totals kWh/year													
Space heating fuel - main system												1020.9307	(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)												326.1512	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.10 * 951 * 1.00) =												-76.0493	(233)
Total delivered energy for all uses												3117.4320	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1020.9307	3.4800	35.5284 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1771.3993	3.4800	61.6447 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	326.1512	13.1900	43.0193 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	0.0000	0.0000 (252)
Total energy cost			270.0849 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	0.9680 (257)
SAP value	86.4969
SAP rating (Section 12)	86 (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	1020.9307	0.2160	220.5210 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1771.3993	0.2160	382.6222 (264)
Space and water heating			603.1433 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.1512	0.5190	169.2725 (268)
Energy saving/generation technologies			
PV Unit	-76.0493	0.5190	-39.4696 (269)
Total kg/year			771.8712 (272)
CO2 emissions per m2			10.6900 (273)
EI value			91.1741
EI rating			91 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8808 = 3.951$, stars = 4
Water heating environmental impact	$0.216 / 0.8808 = 0.2452$, stars = 4

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Calculation Type: New Build (As Designed)



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Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	72.1900 (1b)	x 2.4000 (2b)	= 173.2560 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	72.1900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 173.2560 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design q50					5.0000
Infiltration rate					0.2500 (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) =				0.2125 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.2338	0.2178	0.2178	0.2072	0.2072	0.1806	0.1806	0.1753	0.1806	0.2019	0.1966	0.2125 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												0.5000 (25)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			1.9500	1.0000	1.9500		(26)
Opening Type 2 (Uw = 1.30)			12.8100	1.2357	15.8298		(27)
External Wall 1	40.5400	14.7600	25.7800	0.2000	5.1560		(29a)
Total net area of external elements Aum(A, m ²)			40.5400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.9358		(33)
Party Wall 1			16.3200	0.0000	0.0000		(32)
Party Floor 1			72.1900				(32d)
Party Ceilings 1			72.1900				(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.4259 (36)
Total fabric heat loss							(33) + (36) = 29.3618 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872	28.5872 (38)
Heat transfer coeff	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490	57.9490 (39)
Average = Sum(39)m / 12 =												57.9490 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027	0.8027 (40)
HLP (average)												0.8027 (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												2.2981 (42)
Average daily hot water use (litres/day)												88.7798 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.6578	94.1066	90.5554	87.0042	83.4530	79.9018	79.9018	83.4530	87.0042	90.5554	94.1066	97.6578 (44)
Energy conte	144.8237	126.6637	130.7056	113.9523	109.3400	94.3521	87.4311	100.3284	101.5267	118.3195	129.1550	140.2540 (45)
Energy content (annual)												Total = Sum(45)m = 1396.8521 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.7236	18.9996	19.6058	17.0928	16.4010	14.1528	13.1147	15.0493	15.2290	17.7479	19.3733	21.0381 (46)
Water storage loss:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.0960	12.7114	14.0406	13.5507	13.9756	13.4937	13.9242	13.9575	13.5248	14.0137	13.6045	14.0853	(61)
Total heat required for water heating calculated for each month	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	158.9197	139.3751	144.7462	127.5031	123.3155	107.8458	101.3553	114.2859	115.0515	132.3332	142.7595	154.3393	(64)
Heat gains from water heating, kWh/month	51.6779	45.2935	46.9698	41.2768	39.8494	34.7455	32.5519	36.8486	37.1388	42.8447	46.3452	50.1558	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	137.8858	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.1701	41.0079	33.3498	25.2480	18.8732	15.9335	17.2167	22.3789	30.0370	38.1388	44.5137	47.4533	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	302.0201	305.1541	297.2565	280.4433	259.2198	239.2726	225.9467	222.8126	230.7103	247.5234	268.7470	288.6941	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	51.0867	(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)	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	-91.9239	(71)
Water heating gains (Table 5)	69.4595	67.4011	63.1314	57.3289	53.5611	48.2576	43.7525	49.5277	51.5817	57.5869	64.3683	67.4137	(72)
Total internal gains	517.6983	513.6116	493.7863	463.0688	431.7026	403.5124	386.9645	394.7679	412.3776	443.2978	477.6776	503.6097	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.0800	12.7500	0.7200	0.7000	0.7700		4.8095 (74)	
East					11.7300	23.7835	0.7200	0.7000	0.7700		97.4400 (76)	
Solar gains	102.2495	174.6105	285.5886	424.0589	508.1721	551.3708	519.2835	453.2511	354.3780	222.3541	125.5445	84.6123 (83)
Total gains	619.9478	688.2221	779.3750	887.1278	939.8746	954.8831	906.2481	848.0190	766.7555	665.6519	603.2221	588.2220 (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	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	86.5104	
alpha	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	6.7674	
util living area	0.9780	0.9559	0.8792	0.7108	0.5090	0.3276	0.2174	0.2460	0.4671	0.7815	0.9497	0.9832 (86)	
MIT	20.5463	20.6662	20.8490	20.9663	20.9965	20.9998	21.0000	21.0000	20.9984	20.9499	20.7333	20.5075 (87)	
Th 2	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510	20.2510 (88)	
util rest of house	0.9720	0.9448	0.8542	0.6709	0.4642	0.2822	0.1695	0.1948	0.4114	0.7356	0.9350	0.9785 (89)	
MIT 2	19.6672	19.8349	20.0786	20.2180	20.2483	20.2509	20.2510	20.2510	20.2500	20.2037	19.9306	19.6123 (90)	
Living area fraction									fLA = Living area / (4) =			0.3254 (91)	
MIT	19.9532	20.1054	20.3293	20.4615	20.4917	20.4946	20.4947	20.4947	20.4936	20.4465	20.1918	19.9036 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	19.8032	19.9554	20.1793	20.3115	20.3417	20.3446	20.3447	20.3447	20.3436	20.2965	20.0418	19.7536 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9676	0.9397	0.8516	0.6743	0.4696	0.2879	0.1755	0.2012	0.4183	0.7386	0.9302	0.9746	(94)
Useful gains	599.8595	646.7271	663.7366	598.1540	441.3885	274.9018	159.0513	170.6392	320.7251	491.6352	561.1405	573.2815	(95)
Ext temp.	4.9000	5.5000	7.3000	9.7000	12.7000	15.6000	17.6000	17.4000	14.8000	11.4000	7.8000	4.9000	(96)
Heat loss rate W	863.6287	837.6740	746.3427	614.9257	442.8307	274.9447	159.0523	170.6418	321.2435	515.5440	709.4000	860.7509	(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	196.2443	128.3164	61.4590	12.0756	1.0730	0.0000	0.0000	0.0000	0.0000	17.7882	106.7468	213.8772	(98)
Space heating												737.5804	(98)
Space heating per m2										(98) / (4) =		10.2172	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	815.0060	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	196.2443 128.3164 61.4590 12.0756 1.0730 0.0000 0.0000 0.0000 0.0000 17.7882 106.7468 213.8772	(98)
Space heating efficiency (main heating system 1)	90.5000 90.5000 90.5000 90.5000 90.5000 0.0000 0.0000 0.0000 0.0000 90.5000 90.5000 90.5000	(210)
Space heating fuel (main heating system)	216.8445 141.7860 67.9105 13.3433 1.1856 0.0000 0.0000 0.0000 0.0000 19.6554 117.9523 236.3284	(211)
Water heating requirement	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000	(215)
Water heating requirement	158.9197 139.3751 144.7462 127.5031 123.3155 107.8458 101.3553 114.2859 115.0515 132.3332 142.7595 154.3393	(64)
Efficiency of water heater (217)m	89.0396 88.8052 88.2298 87.5679 87.3266 87.3000 87.3000 87.3000 87.3000 87.6673 88.6409 87.3000	(216)
Fuel for water heating, kWh/month	178.4820 156.9448 164.0559 145.6048 141.2118 123.5347 116.1000 130.9117 131.7886 150.9494 161.0537 173.1609	(219)
Water heating fuel used		1773.7982 (219)
Annual totals kWh/year		
Space heating fuel - main system		815.0060 (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)		326.1512 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 0.10 * 1044 * 1.00) =		-83.4835 (233)
Total delivered energy for all uses		2906.4719 (238)

10a. Fuel costs - using BEDF prices (429)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	815.0060	3.9400	32.1112 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1773.7982	3.9400	69.8877 (247)
Pumps and fans for heating	75.0000	16.5500	12.4125 (249)
Energy for lighting	326.1512	16.5500	53.9780 (250)
Additional standing charges			87.0000 (251)
Energy saving/generation technologies			
PV Unit	0.0000	0.0000	0.0000 (252)
Total energy cost			255.3894 (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	815.0060	0.2160	176.0413 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1773.7982	0.2160	383.1404 (264)
Space and water heating			559.1817 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	326.1512	0.5190	169.2725 (268)
Energy saving/generation technologies			
PV Unit	-83.4835	0.5190	-43.3279 (269)
Total kg/year			724.0513 (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	815.0060	1.2200	994.3073 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1773.7982	1.2200	2164.0339 (264)
Space and water heating			3158.3412 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	326.1512	3.0700	1001.2843 (268)
Energy saving/generation technologies			
PV Unit	-83.4835	3.0700	-256.2944 (269)
Primary energy kWh/year			4133.5811 (272)
Primary energy kWh/m2/year			57.2597 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Current energy efficiency rating: B 86
Current environmental impact rating: B 91

(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
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 86
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 429 TEST (25 Jun 2018)
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	£66	£66	£0
Mains gas	£189	£189	£0
Space heating	£132	£132	£0
Water heating	£70	£70	£0
Lighting	£54	£54	£0
Total cost of fuels	£255	£255	£0
Total cost of uses	£256	£256	£0
Delivered energy	40 kWh/m²	40 kWh/m²	0 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.7 tonnes	0.0 tonnes
CO2 emissions per m²	10 kg/m²	10 kg/m²	0 kg/m²
Primary energy	57 kWh/m²	57 kWh/m²	0 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

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 Yes
 SAP Region Thames Valley
 Front of dwelling faces West
 Overshading Average or unknown
 Thermal mass parameter 250.0
 Night ventilation Yes
 Ventilation rate during hot weather (ach) 3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 171.52 (P1)
 Transmission heat loss coefficient 29.36 (37)
 Summer heat loss coefficient 200.89 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
East	0.000	1.000	None
Solar shading			
Orientation	Z blinds	Solar access	Z overhangs Z summer
North	1.000	0.90	1.000 0.900 (P8)
East	1.000	0.90	1.000 0.900 (P8)
[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b
North	1.0800	81.1852	0.7200
East	11.7300	117.5071	0.7200
total:			598.4953

	Jun	Jul	Aug	
Solar gains	636	598	524	(P3)
Internal gains	401	384	392	
Total summer gains	1037	982	916	(P5)
Summer gain/loss ratio	5.16	4.89	4.56	(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	21.41	23.04	22.61	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			

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