



CAVERSHAM PARK,
READING

ENERGY STRATEGY AND SUSTAINABILITY STATEMENT

MARCH • 2022 (REV B)

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1 EXECUTIVE SUMMARY

- 1.1 This Energy Strategy and Sustainability Statement has been prepared by Resi Resolve, appointed by Beechcroft Developments Ltd to demonstrate how the development at Caversham Park will meet the sustainability requirements of Policy CC2, CC3, CC4, CC5, EN18 and H5 of the Reading Borough Councils Local Plan (Adopted November 2019).
- 1.2 The energy strategy outlined within this report demonstrates that the development achieves a total 36% reduction in regulated carbon dioxide, using the SAP (2012) methodology and the Carbon Emissions Reporting Spreadsheet. Further savings to comply with Zero Carbon Homes will be achieved through off site solutions via a cash-in-lieu contribution.
- 1.3 The resultant carbon savings at each stage of the energy hierarchy is displayed in Tables 1, 2 and Figure 1 below.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.4	1.77
After energy demand reductions (be lean)	10.3	
After heat network connection (be clean)	9.9	
After renewable energy (be green)	7.3	

Table 1: Carbon dioxide emissions after each stage of the energy hierarchy

	Regulated carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reductions	1.1	10%
Be clean: Savings from heat network	0.4	3%
Be green: Savings from renewable energy	2.6	23%
Cumulative on-site savings	4.0	36%
Carbon shortfall	7.3	
	(Tonnes CO ₂)	
Cumulative savings for offset payment	219	
Cash-in-lieu contribution	£13,161	

Table 2: Regulated carbon dioxide savings from each stage of the energy hierarchy

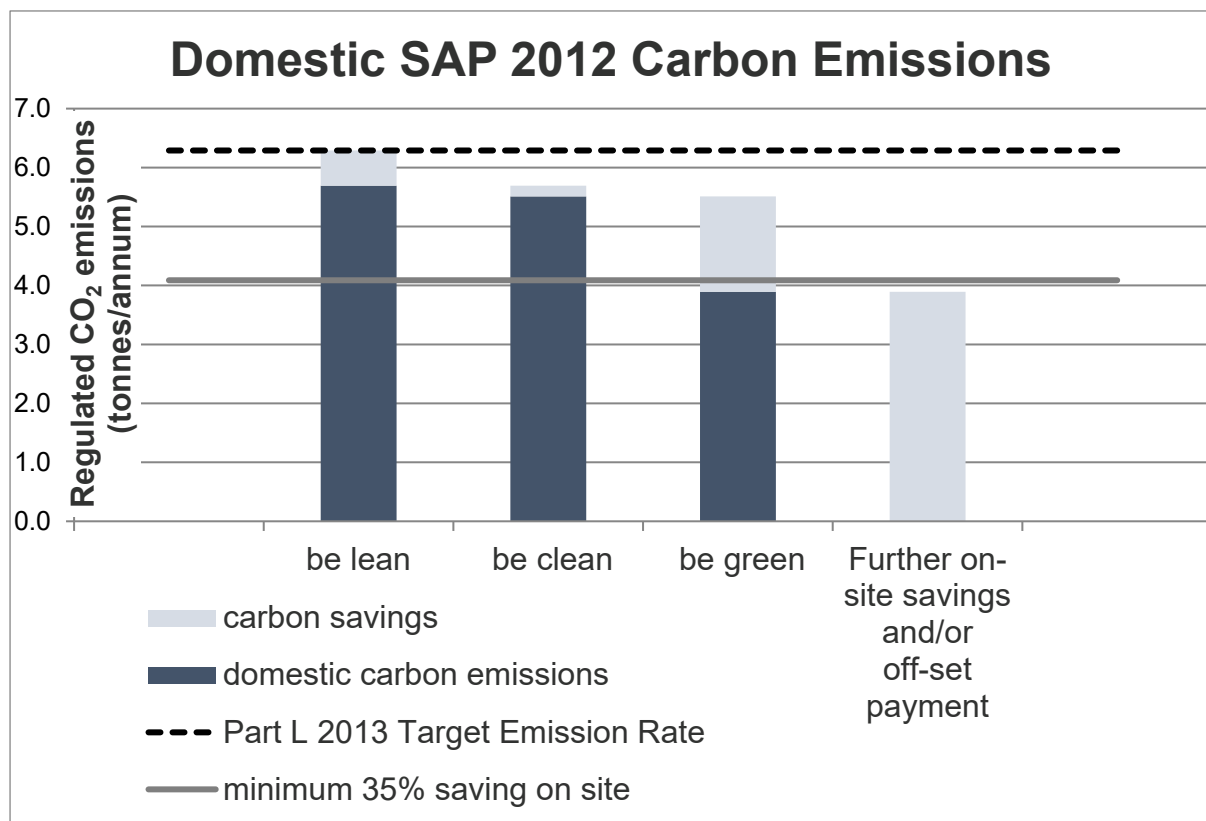


Figure 1: Regulated carbon dioxide emissions, savings, and targets

- 1.4 An overheating assessment has been carried out. The energy (SAP) calculations demonstrate a 'not significant' overheating risk in compliance with Criterion 3 'Limiting the Effects of Heat Gains in Summer' of Building Regulations Approved Document Part L.
- 1.5 A Sustainability Statement has been prepared (Part 2) which addresses the applicant's dedication to key sustainability issues, including water use reductions, waste minimisation, the protection and enhancement of ecological features, health and well-being, and reduction in pollution.

2 INTRODUCTION

- 2.1 This Energy Strategy and Sustainability Statement has been prepared by Resi Resolve, appointed by Beechcroft Developments Ltd (hereafter referred to as the Applicant) to review and report on the energy and sustainability strategy for the redevelopment of Caversham Park for; 64 assisted living units (Class C2) for the over 55's through conversion of Caversham Park House; 64 bed care home (Class C2); 61 age restricted retirement dwellings (class C3); market dwellings (class C3); 28 affordable dwellings (class C3); and refurbishment and extension of the existing pavilion to provide enhanced changing facilities, café/studio and sports provision comprising 2 no. croquet lawns, 2 no. bowling greens, an additional tennis court, refurbishment of the existing tennis court and associated parking and landscaping following the demolition of unsympathetic extensions and associated outbuildings to the main house and removal of twentieth century satellite dishes and associated infrastructure.

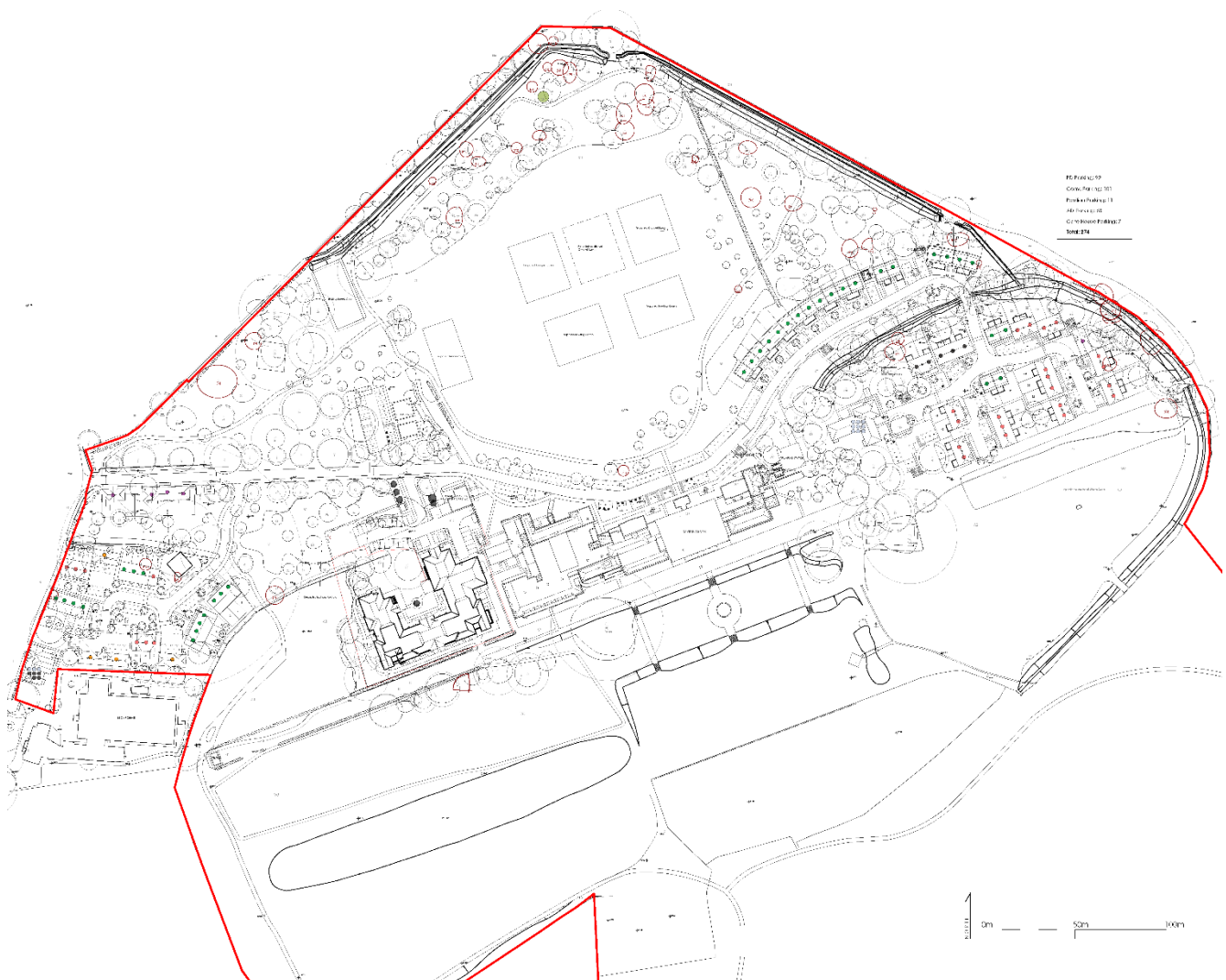


Figure 2: Site Masterplan

3 METHODOLOGY

- 3.1 Resi Resolve will carry out a comprehensive review of the sustainability principles outlined within Reading Borough Council's Local Plan (Adopted November 2019).
- 3.2 This strategy will identify the carbon footprint for the development at Caversham Park after each stage of the energy hierarchy.

CARBON EMISSION FACTORS

- 3.3 Planning applicants are encouraged to use the SAP 10 emission factors when estimating CO₂ emission performance against policy. The estimated carbon emissions for Caversham Park will be calculated using the current Building Regulations methodology (SAP 2012) for estimating energy performance against Part L 2013 requirements, but with the outputs manually converted for the SAP 10.0 emission factors using the Carbon Emissions Reporting Spreadsheet (Appendix B).

ESTABLISHING CO₂ EMISSIONS

- 3.4 The energy strategy will clearly identify the carbon footprint of the development after each stage of the energy hierarchy. The following tables will be used to demonstrate compliance with the energy hierarchy and the carbon targets. Savings will be expressed in tonnes of CO₂ per annum, not kg CO₂/m² per annum.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	A	
After energy demand reductions (be lean)	B	
After heat network connection (be clean)	C	
After renewable energy (be green)	D	

Table 3: The energy hierarchy

	Regulated carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reductions	A – B	(A – B)/A * 100
Be clean: Savings from heat network	B – C	(B – C)/A * 100
Be green: Savings from renewable energy	C – D	(C – D)/A * 100
Cumulative on-site savings	A – D = E	(A – D)/A * 100
Carbon shortfall	A – E = F	
	(Tonnes CO ₂)	
Cumulative savings for offset payment	F * 30 years = G	
Cash-in-lieu contribution	G * carbon dioxide offset price = H	

Table 4: Regulated carbon dioxide savings from each stage of the energy hierarchy

CARBON OFFSETTING

- 3.5 If the zero-carbon target cannot be achieved, then the remaining carbon emissions will be multiplied by the lifetime of the development to give the cumulative shortfall. This will then be multiplied by the carbon dioxide offset price to determine the required cash-in-lieu contribution.
- 3.6 Reading Borough Council have adopted the nationally recognised price of carbon established by the Zero Carbon Hub. This sets the price for the offsetting of carbon at £60 per tonnes of CO₂ emissions. The total contribution will be collected through the Section 106 process and spent on carbon-reduction projects.
- 3.7 The Carbon Reporting Spreadsheet will be completed and included in Appendix B; a summary will be provided in section 11.

CALCULATING REGULATED CO₂ EMISSIONS FOR A PART L 2013 COMPLIANT DEVELOPMENT

- 3.8 The Energy Strategy will establish the regulated CO₂ emissions after achieving compliance with Building Regulations Approved Document Part L. This will be established using approved compliance methodology, SAP 2012 for Dwellings.

CALCULATING REGULATED CO₂ EMISSION AT EACH STAGE OF THE ENERGY HIERARCHY

- 3.9 Energy consumed in the operation of space heating/cooling and hot-water systems, ventilation and internal lighting is classified as regulated emissions. Regulation emissions will be calculated using the method outlined within the GLA Energy Assessment Guidance (a robust, overarching report that can be used to supplement the development of all Energy Strategies). The Guidance states that regulated emissions must establish:

“Dwellings: A Dwelling CO₂ Emissions Rate (DER) calculated through the Part L 2013 of the Building Regulations methodology SAP 2012. This is multiplied by the cumulative floor area for the particular dwelling type in question to give the related CO₂ emissions. In terms of the extent of modelling work required, the applicant must provide information for a representative sample of domestic properties.”

- 3.10 A sample of dwelling types will be modelled to calculate each stage of the energy hierarchy. All sample dwelling types will be modelled as ‘north-facing’ with careful consideration given to selecting dwellings with larger areas of external wall (detached houses, corner apartments, etc), this represents the worst-case scenario due to the number of heat loss walls and increased heating demands. This is a robust depiction of the predicted carbon emissions, a full energy (SAP) assessment will be provided upon achieving successful planning permission and completion of working drawings.

UNREGULATED CO₂ EMISSIONS

- 3.11 Unregulated emissions include cooking or use of appliances and are not assessed under Building Regulations Approved Document Part L. SAP 2012 provides a calculation output for cooking and appliances. The total unregulated emissions will be calculated and presented within the report.

SUSTAINABILITY

- 3.12 The Applicant has an aspiration to incorporate sustainable design principles beyond minimum standards. These will be explored further in the Section 2: Sustainability.

4 PLANNING POLICY

- 4.1 To support the planning application for the proposed development, Resi Resolve has carried out a comprehensive review of the developments opportunities to embrace sustainability principles outlined within Reading Borough Councils Local Plan (Adopted November 2019).
- 4.2 This Energy Strategy and Sustainability Statement will outline how the Applicant's proposals at Caversham Park will respond to the sustainability requirements of Policy CC2, CC3, CC4, CC5, EN18 and H5.
- 4.3 The specific wording of each policy is provided below:

CC2: SUSTAINABLE DESIGN AND CONSTRUCTION

"Proposals for new development, including the construction of new buildings and the redevelopment and refurbishment of existing building stock, will be acceptable where the design of buildings and site layouts use energy, water, minerals, materials and other natural resources appropriately, efficiently and with care and take account of the effects of climate change.

To meet these requirements:

- All major non-residential developments or conversions to residential are required to meet the most up to date BREEAM 'Excellent' standards, where possible.*
- All minor non-residential developments or conversions to residential are required to meet the most up to date BREEAM 'Very Good' standard as a minimum.*
- All non-residential development or conversions to residential should incorporate water conservation measures so that predicted per capita consumption does not exceed the appropriate levels set out in the applicable BREEAM standard. Both residential and non-residential development should include recycling greywater and rainwater harvesting where systems are energy and cost effective."*

CC3: ADAPTATION TO CLIMATE CHANGE

"All developments will demonstrate how they have been designed to incorporate measures to adapt to climate change. The following measures shall be incorporated into development:

- *Wherever possible, new buildings shall be orientated to maximise the opportunities for both natural heating and ventilation and reducing exposure to wind and other elements.*
- *Proposals involving both new and existing buildings shall demonstrate how they have been designed to maximise resistance and resilience to climate change for example by including measures such as solar shading, thermal mass, heating and ventilation of the building and appropriately coloured materials in areas exposed to direct sunlight, green and brown roofs, green walls, etc.*
- *Use of trees and other planting, where appropriate as part of a landscape scheme, to provide shading of amenity areas, buildings, and streets and to help to connect habitat, designed with native plants that are carefully selected, managed and adaptable to meet the predicted changed climatic conditions; and*
- *All development shall minimise the impact of surface water runoff from the development in the design of the drainage system, and where possible incorporate mitigation and resilience measures for any increases in river flooding levels as a result of climate change.”*

CC4: DECENTRALISED ENERGY

“In meeting the sustainability requirements of this plan, developments of the sizes set out below shall demonstrate how consideration has been given to securing energy for the development from a decentralised energy source.

Any development of more than 20 dwellings and/or non-residential development of over 1,000 sq. m shall consider the inclusion of decentralised energy provision, within the site, unless it can be demonstrated that the scheme is not suitable, feasible or viable for this form of energy provision.

Where there is existing decentralised energy provision present within the vicinity of an application site, further developments of 10 dwellings or more or non-residential development of 1,000 sq. m or more will be expected to link into the existing decentralised energy network or demonstrate why this is not feasible.”

CC5: WASTE MINIMISATION AND STORAGE

“Development should demonstrate measures to minimise the generation of waste in the construction, use and life of buildings and promote more sustainable approaches to waste management, including the reuse and recycling of construction waste and the promotion of layouts and designs that provide adequate, well-designed space to facilitate waste storage, reuse, recycling and composting.”

EN18: FLOODING AND SUSTAINABLE DRAINAGE SYSTEMS

“Development will be directed to areas at lowest risk of flooding in the first instance, following the Sequential and Exceptions Test set out in the NPPF, and taking into account the effects of climate change. It will consider flooding from all sources, including fluvial, surface water, groundwater, and sewer flooding. Where development in areas at risk of flooding is necessary, it will not reduce the capacity of the flood plain to store floodwater, impede the flow of floodwater or in any way increase the risks to life and property arising from flooding. Wherever possible, development should be designed to reduce flood risk, both on- and off-site.

All major developments must incorporate sustainable drainage systems (SuDS) as appropriate and in line with the Government’s Technical Standards⁶⁴. Smaller schemes are encouraged to incorporate SuDS, where possible. Runoff rates should aim to reflect greenfield conditions and, in any case, must be no greater than the existing conditions of the site. Schemes should ensure that the movement of water through vertical infiltration as well as horizontal run-off does not worsen contamination effects. Wherever possible, SuDS provision should maximise ecological benefits, link into the existing Green Network, incorporate tree planting and landscaping and avoid damage to existing significant trees, including through changes to the site hydrology. All new developments in areas of flood risk should give priority to SuDS.”

H5: STANDARDS FOR NEW HOUSING

New build housing should be built to the following standards, unless it can be clearly demonstrated that this would render a development unviable:

- a) All new build housing outside the Central Area as defined on the Proposals Map will comply with the nationally described space standard.*

- b) All new build housing will be built to the higher water efficiency standard under Regulation 36(3) of the Building Regulations⁷⁹.*
- c) All major new-build residential development should be designed to achieve zero carbon homes.*
- d) All other new build housing will achieve at a minimum a 19% improvement in the dwelling emission rate over the target emission rate, as defined in the 2013 Building Regulations.*
- e) All new build housing will be accessible and adaptable in line with M4(2) of the Building Regulations unless it is built in line with M4(3) (see below).*
- f) On developments of 20 or more new build dwellings, at least 5% of dwellings will be wheelchair user dwellings in line with M4(3) of the Building Regulations. Any market homes provided to meet this requirement will be 'wheelchair adaptable' as defined in part M, whilst homes where the Council is responsible for allocating or nominating an individual may be 'wheelchair accessible'.*

5 PART 1: ENERGY STRATEGY

- 5.1 Resi Resolve has carried out an Energy Strategy for the proposed development at Caversham Park to satisfy the key sustainability policies set out in the Reading Local Plan.
- 5.2 CO₂ savings for the new build dwellings (Part L1A) are shown at each stage of the energy hierarchy throughout this strategy. The refurbished dwellings (Part L1B) will comply with the minimum energy efficiency requirements for existing dwellings set out in Approved Document Part L1B. The applicant is proposing enhanced insulation to meet u-values set by Building Regulations, as illustrated in Table 7 and 8.
- 5.3 The Applicant is committed to making the fullest contribution to minimising carbon dioxide emissions for the dwellings in accordance with the energy hierarchy (be lean, be clean, be green). The Applicant has a commitment to offset carbon where necessary, a commitment which will be secured via a Section 106 (S106) Agreement.
- 5.4 The energy hierarchy is an approach to reducing carbon dioxide emissions in the built environment. "The first step is to reduce energy demand (be lean), the second step is to supply energy efficiently (be clean) and the third step is use renewable energy (be green)." ("Annex Six: Glossary | London City Hall").

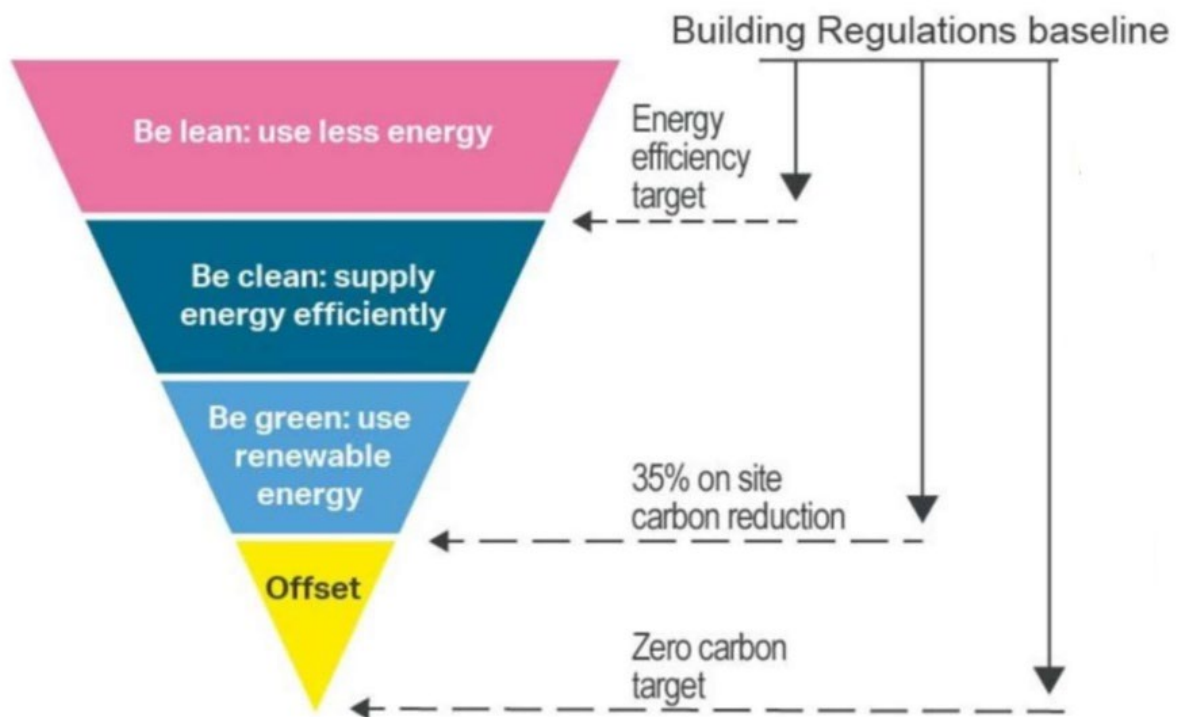


Figure 3: Energy Hierarchy

6 BUILDING REGULATIONS COMPLIANCE (BASELINE)

- 6.1 A Building Regulation (2013) baseline for energy demand has been calculated. The baseline is used as a foundation to demonstrate the reductions in carbon dioxide emissions that will result at each stage of the energy hierarchy.
- 6.2 The baseline requires compliance with the standards set by Building Regulations 'Approved Document Part L1A – Conservation of Fuel and Power in New Dwellings'. These standards include a minimum level for regulated carbon emissions defined by the Target Emission Rate (TER). The TER is calculated based on a 'Notional Building' which is automatically generated as part of the Standard Assessment Procedure (SAP) toolkit. There are also minimum levels of fabric efficiency set by the Target Fabric Energy Efficiency rating (TFEE) within SAP.
- 6.3 The heating and hot water supply will be provided by gas boilers. Active cooling is not planned to be provided to the development.
- 6.4 Table 5 demonstrates the baseline carbon dioxide emissions. The calculated baseline has a total regulated carbon dioxide emissions of 11.4 tonnes CO₂ per annum. The SAP (2012) output worksheets are provided in Appendix A of this report. The total unregulated carbon emissions have also been calculated for the development (table 6). See Appendix B for further calculations using SAP 10 carbon emission factors.

	Regulated carbon dioxide emissions (tonnes CO ₂ per annum)
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.4

Table 5: Baseline regulated carbon dioxide emissions

	Unregulated carbon dioxide emissions (tonnes CO ₂ per annum)
Total for sample types	1.77

Table 6: Unregulated carbon dioxide emissions

7 DEMAND REDUCTION (BE LEAN)

7.1 This strategy now considers both active and passive measures to reduce the energy demand of Caversham Park.

7.2 The following active and passive energy efficient measures are proposed:

ENHANCED PASSIVE MEASURES

7.3 The main fabric (thermal elements) of the dwellings will meet u-values set by Building Regulations, these include the external walls, party walls, floors, and roofs (including glazing in external windows and doors). This will be achieved by installing high levels of insulation which will significantly reduce the energy demand of the dwellings. Improvements over the limiting fabric measures will be incorporated into the design wherever practical.

INSULATION

7.4 Incorporating enhanced layers of insulation in the building envelope (walls, roofs, and floors), together with highly efficient double glazing is a highly sustainable approach as it locks in carbon emissions savings for the lifetime of the building. This strategy will deliver average U-values better than those demanded by Part L1A and Part L1B of 2013 Building Regulations. The proposed U-values for the buildings are illustrated in Table 7 and 8.

Thermal Element	Maximum Area-Weighted U-value (W/m ² K) Allowable Under 2013 Building Regulations	Applicant's Proposed U-value (W/m ² K) required to Meet 2013 Building Regulation Baseline	% Improvement on 2013 Allowable U-Value Standard
Main external walls	0.30	0.20	33
Party Walls	0.20	0.00	100
Roof	0.20	0.10	50
Ground floor	0.25	0.11	56
Windows/doors	2.00	1.3	35
Average Improvement			54%

Table 7: AD Part L1A 2013 Insulation Enhancement Proposals

7.5 Table 7 demonstrates that the enhanced U-values for new dwellings and their fabric thermal elements (walls, roof, floors, and glazing) will provide an average overall improvement of 54% against the requirements of Approved Document Part L1A 2013 of the Building Regulations.

7.6 Table 8 demonstrates that the enhanced U-values for the refurbished/existing dwellings and its fabric thermal elements (walls, roof, floors, and glazing) will provide an average overall improvement of 29% against the requirements of Approved Document Part L1B 2013 of the Building Regulations. These figures will become clearer at the detailed design stage of the planning process.

Thermal Element	Maximum Area-Weighted U-value (W/m ² K) Allowable Under 2013 Building Regulations	Applicant's Proposed U-value (W/m ² K) required to Meet 2013 Building Regulation Baseline	% Improvement on 2013 Allowable U-Value Standard
Walls retained	0.55	0.28	49
Wall new	0.28	0.21	25
Floor retained	0.25	0.25	0
Floor new	0.22	0.11	50
Roof retained	0.18	0.10	44
Roof new	0.18	0.10	44
Windows/Doors retained	3.3/3.3	N/A	N/A
Windows/Doors new	1.6/1.8	1.3/1.1	18/38
Average Improvement			29%

Table 8: AD Part L1B 2013 Insulation Enhancement Proposals

SPACE HEATING

7.7 The space heating requirement of the development will be minimised via the fabric measures detailed above. The proposed development at Caversham Park will also benefit from considerable passive solar gains due to its generally favourable orientation, designed to maximise sunlight penetration and reduce overshadowing, which will further reduce the space heating demand of the development. Furthermore, the internal layout of dwellings will be such that wherever practicable the living areas will face south and therefore benefit from a greater amount of solar gain than the rest of the dwelling, which does not have as high a heating demand.

AIR TIGHTNESS

7.8 Air tightness standards will conform to Approved Document Part L1A accredited details. These details incorporate an improvement over Building Regulations (2013) requirements by reducing air leakage loss and convective bypass of insulation. An improvement of design air permeability from 10 to 5m³/hm² further reduces space heating requirements.

THERMAL BRIDGES

- 7.9 In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which occur when highly conductive elements (e.g., metals) in the wall construction enable a low resistance escape route for heat. It is proposed that all dwellings within the development will comply with the Constructive Details for non-repeating thermal bridges.

LIGHTING AND APPLIANCES

- 7.10 100% of internal lighting throughout the development will be of the low energy type. External lighting will also be low energy and controlled through PIR sensors or daylight cut-off devices.

SUSTAINABLE DESIGN

- 7.11 The development is in keeping with the surrounding urban form in terms of height and massing. It has been designed in such a way that wind speeds will not be increased through the wind tunnel effect.
- 7.12 The orientation and configuration of development will make little contribution to urban heat island effect. Deciduous trees which can bring solar shading in summer and promote sunlight penetration in winter are to be incorporated as an aspect of the landscape plan. The creation of landscaping zones will also help to enhance the local microclimate and counter air pollution.

DEMONSTRATING CO2 SAVINGS FROM DEMAND REDUCTION MEASURES

- 7.13 Table 9 below shows the total regulated carbon emissions and percentage of carbon dioxide savings over the baseline when the passive and active measures are applied to the Caversham Park development. The SAP (2012) output worksheets are provided in Appendix A of this report. See Appendix B for further calculations using SAP 10 carbon emission factors.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	Regulated carbon dioxide savings (%)
Baseline: Part L 2012 of the Building Regulations Compliant Development	11.4	-
After energy demand reductions (be lean)	10.3	10%
Total carbon dioxide savings (%)		10%

Table 9: Baseline and 'be lean' regulated carbon dioxide emissions

7.14 The 'be lean' case demonstrates total carbon dioxide emissions of 10.3 tonnes CO₂ per annum. This is a total 10% reduction in regulated carbon emissions against the Part L compliant baseline.

8 HEATING INFRASTRUCTURE (BE CLEAN)

8.1 Following the reduction of energy demand outlined in the previous step (be lean), this strategy now considers the potential exploit of local energy resources and how energy can be supplied efficiently and cleanly to reduce CO₂ emissions. An appropriate heat source has been selected in accordance with the following heating hierarchy:

- a) connect to local existing or planned heat networks
- b) use zero-emission or local secondary heat sources (in conjunction with heat pump, if required)
- c) use low-emission combined heat and power (only where there is a case for CHP to enable the delivery of an area-wide heat network, meet the development's electricity demand and provide demand response to the local electricity network)
- d) use ultra-low NO_x gas boilers

LOCAL EXISTING OR PLANNED HEAT NETWORK

8.2 Applicants must prioritise the connection to a heat network if in the vicinity of the proposed development and provide evidence of active two-way correspondence with the network operator.

8.3 Connection to a heat network is an efficient solution for providing space and water heating developments in an urban setting which has a high heat density, they also enable the use of secondary energy or waste heat sources. This creates low quality energy which can be used and re-used, to meet both low- and high-quality energy demands. Heat networks provide a system-level approach which allows demand to be managed through a storage provision and the protection of existing capacity in the local electricity network. This allows for added capacity for additional development and the ability to increase volumes of renewable energy into the grid mix.

8.4 Investigation into the potential for connecting the development to an existing heat network system has been undertaken using the Heat Network Planning Database (HNPD). Figure 4 below shows that the development is not situated in a high heat density area, and no future networks are planned.



8.5 The second step of the heating hierarchy considers the use of locally available energy sources. It is recommended that secondary sources are used before renewable sources but can be used in conjunction.

- Heat from sewerage system
- Sewage treatment plants
- Tube network
- Data centres
- Chiller systems

- 8.7 Investigation into the potential for connecting the development to a local secondary heat source has been undertaken using the Renewable Energy Planning Database. Figure 5 below shows that the development is not situated near a secondary heat source.



Figure 5: Renewable Energy Planning Database search for Caversham Park

LOW-EMISSION COMBINED HEAT AND POWER (CHP)

- 8.8 CHP is suited for large, mixed-use developments where there is a diversity of energy uses and ongoing demand. These features allow electricity to be generated for extended periods and minimise the risk of an over-generation of heat. The total costs of any CHP installation would also be significant. It is more appropriate for the development to implement more cost effective and efficient measures to achieve a sustainable reduction in energy demand. This is backed by the GLA Energy Assessment Guidance which states that only *“larger sites are considered appropriate in terms of operational regime and available heat load to enable an effective operation of CHP systems, providing that any related emissions are properly abated.”*
- 8.9 A considerable amount of renewable energy forms the UK electricity grid, with 30% of all generation from renewables in 2018 and 20% from nuclear, creating a continuing

decarbonisation of the grid. This impacts the efficacy of the carbon reductions which can be attained from gas-fired CHP. Predictions states that electricity generated by CHP will be more carbon intensive than gas boilers by 2030. This will remove gas-fired CHP as carbon-saving measures and because of this combustion-based CHP should be avoided. A CHP approach utilising fuel cells to produce electricity through the electrochemical reaction of hydrogen and oxygen which produces heat as a by-product would be an acceptable approach however the commercial readiness and viability of these technologies is currently challenging. Reading Borough Councils Local Plan advises that *“air-source heat pumps or ground-source heat pumps should be considered in the first instance, as these methods are less carbon intensive than CHP.”*

- 8.10 For all the above reasons, the Applicant will not be installing CHP to Caversham Park.

ULTRA-LOW NOX GAS BOILERS

- 8.11 An ultra-low NOx gas boiler should only be considered when all previous stages of the energy hierarchy has been deemed unviable, this is the case for the Caversham Park development.
- 8.12 A Class 5 gas boilers of greater than 90% efficiency, combined with positioning radiators away from windows, will further reduce the energy demand. The boiler used for the purpose of the calculations remains the same as that used within the baseline and ‘be lean’ case. Stringent energy ratings of boilers means that new boilers on the market are highly energy efficient. Improvements have however been made to the heating controls. The dwellings will benefit from time and temperature zone control which allows future occupants to programme the heating times of at least two space heating zones independently, in addition to having independent heating controls. The boiler flow temperature has also been limited to between 36-45 degrees Celsius to provide further energy savings.
- 8.13 Table 10 below shows the total carbon emissions and percentage improvement over the baseline and ‘be lean’ stage when improved heating specifications are applied to the Caversham Park development. The SAP (2012) output worksheets are provided in Appendix A of this report. See Appendix B for further calculations using SAP 10 carbon emission factors.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	Regulated carbon dioxide savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.4	-
After energy demand reductions (be lean)	10.3	10%
After heat network connection (be clean)	9.9	3%
Total carbon dioxide savings (%)		13%

Table 10: Baseline, 'be lean' and 'be clean' regulated carbon dioxide emissions

8.14 The 'be clean' case demonstrates total carbon dioxide emissions of 9.9 tonnes CO₂ per annum. This is a 3% reduction in regulated carbon emissions against the 'be lean' case and a total carbon dioxide saving of 13%.

9 COOLING AND OVERHEATING

- 9.1 The following identifies any potential overheating risk and proposals to incorporate suitable passive measures to mitigate overheating and reduce cooling demand.

THE COOLING HIERARCHY

- 9.2 A cooling hierarchy which should be applied to both major and minor developments. The below identifies the categories that should be addressed and the applicants' proposals:

- 1) Reduce the amount of heat entering the building through orientation, shading, high albedo materials, fenestration, insulation, and the provision of green infrastructure
- 2) Minimise internal heat generation through energy efficient design
- 3) Manage the heat within the building through exposed internal thermal mass and high ceilings
- 4) Provide passive ventilation
- 5) Provide mechanical ventilation
- 6) Provide active cooling systems

- 9.3 The proposed development at Caversham Park will benefit from considerable passive solar gains due to its generally favourable orientation, designed to maximise sunlight penetration and reduce overshadowing, which will further reduce the space heating demand of the development. The internal layout of dwellings will be such that wherever practicable the living areas will face south and therefore benefit from a greater amount of solar gain than the rest of the dwelling, which does not have as high a heating demand.

- 9.4 It is not intended to provide any form of mechanical cooling within the proposed development as the overheating risk is 'not significant'.

- 9.5 Passive measures will be taken to ensure that the risk of summer overheating is limited and to improve resilience to the anticipated effect of climate change. Accessible windows will be installed in all dwellings to encourage natural ventilation. Furthermore, trees and extensive areas of green open space will be provided as part of the development. They facilitate localised cooling through evapotranspiration – the energy which would otherwise heat the

local environment is used as latent heat to evaporate water. The deciduous trees will provide shading in the summer and solar gains in the winter.

OVERHEATING RISK ANALYSIS

- 9.6 The energy (SAP) calculations demonstrate a 'not significant' overheating risk in compliance with Criterion 3 'Limiting the Effects of Heat Gains in Summer' of Building Regulations Approved Document Part L. This calculation includes the combined impact of location, overshadowing, window area, air change rate and installation of curtains or blinds (worst case 'none').

10 RENEWABLE ENERGY (BE GREEN)

- 10.1 This strategy now considers all renewable technologies that theoretically could be installed at the Caversham Park development.

BIOMASS

- 10.2 Biomass boilers installed to serve the whole site would require a central energy centre, fuel store and extensive heat distribution network. The costs of this infrastructure would be akin to a CHP installation. Alternatively, individual dwellings could, theoretically, install a biomass boiler and fuel store within the dwelling. However, such an installation is not recommended as the infrastructure requires a whole room within a dwelling, significantly reducing available space for occupants.

WIND TURBINES

- 10.3 The installation of wind turbines at Caversham Park is theoretically one of the most cost-effective means of generating a substantial fraction of the site's energy demand. This conclusion is borne by analysis of the DTI wind resource database for the site location, which confirms a typical average wind speed of 5.1m/s (10m AOD).
- 10.4 However, the British Wind Energy Association (BWEA) generally recommends an average wind speed of at least 7m/s for viable system performance. Sites such as the location of this development are also generally unsuitable for wind turbine installations due to the interrupted turbulent wind flows caused by surrounding buildings and mature trees. There are also possible issues with noise and 'flicker' for the neighbouring buildings.
- 10.5 The nature of the site and low average wind speeds mean that a wind turbine cannot be recommended as a viable option for this development.

HYDRO POWER

- 10.6 Hydro power installations are not feasible due to the absence of a major watercourse flowing through or adjacent to the development.

GROUND SOURCE HEAT PUMPS

- 10.7 Ground Source Heat Pumps (GSHPs) takes advantage of the stable ground temperature of 12 degrees Celsius to heat either air or water to provide energy efficient heating (and optional comfort cooling) to a dwelling. The energy flow is driven by the temperature difference between the ground and circulating fluid which can then be used to deliver heating to a dwelling. Elements are laid underground on land adjacent to the dwelling. For properties that are short of space, an alternative to traditional horizontal coils is a vertical installation via boreholes. However, even this type of installation requires boreholes of 100m depth spaced out at 6m intervals, an arrangement which is likely to be unavailable at the proposed development due to space constraints. Another concern with GSHPs derives from the efficiency of such systems – although the more efficient heat pumps on the market deliver 90% of a home’s heating and hot water needs, an electric immersion back-up system is needed to keep up with winter demand. As the immersion heater is driven purely by grid electricity, this diminishes the energy savings deriving from the GSHP.

AIR SOURCE HEAT PUMPS

- 10.8 Air Source Heat Pumps (ASHPs) operate similarly to their ground source counterparts and in much the same way as a reverse refrigerator, converting low grade heat from a large ‘reservoir’ into higher temperature heat for input into a smaller space. Electricity drives the pump which extracts heat from the air as it flows over the coils in the heat pump unit. A compressor in heat pump upgrades the temperature of the extracted energy which can then be used for space heating and hot water. Unlike GSHPs there is not a requirement for ground works with ASHPs, although the siting of the heat pump unit needs to be carefully considered.
- 10.9 Overall ASHPs represent the most suitable renewable energy technology for the development as they can provide significant carbon savings compared to 2013 Building Regulations without having a large detrimental effect to the development’s appearance. The upcoming changing to SAP will result in electric or heat pump derived heating and hot water becoming the standard industry approach for future developments as the carbon factor for grid derived electricity has reduced by 75%. This will further enhance the carbon saving capacities of the development thus providing a future proofed development which fits with the approaching Future Homes Standard.

SOLAR THERMAL PANELS

- 10.10 Solar Thermal panels constitute water or glycol circulating 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. However, systems of this kind require expensive dual coil water cylinders which demand space within the property and therefore are not considered suitable.

SOLAR PHOTOVOLTAIC

- 10.11 Solar photovoltaic (PV) panels theoretically represent a suitable renewable energy technology in terms of their energy saving potential. This is due to their ease of installation, favourable southerly orientation, and capacity for achieving significant energy savings. However considerable carbon reductions circa 40% would require a sizable PV unit which requires suitable roof space which could be impractical and considered a visual blight.

Technology	Feasible?	Recommended?	Why?
Solar PV	✓	✗	Roof space is insufficient to house the amount of PV required; will be a visual blight for the development.
Solar thermal	✓	✗	Similar attributes as per PV but also requires expensive dual coil water cylinders.
Ground Source Heat Pump	✗	✗	Insufficient land is available for all dwelling types; significant and costly civic work required to install necessary pipework.
Air Source Heat Pump	✓	✓	Ability to provide large carbon reductions without compromising the appearance. Supports the move away from grid derived gas.
Micro-CHP	✗	✗	Suitable in place of a gas boiler but expensive and has high NOx emissions which could create a local air quality management problem.
Biomass	✗	✗	Requires a plant room, gas boiler back up and space for fuel storage and deliveries. Heat distribution system not economical for a site on this scale.
Hydro	✗	✗	No available watercourse.
Wind	✗	✗	Sufficient wind speed available but contentious from a planning perspective; likely to lead to a community 'backlash'. Costly.

Table 11: Renewable Feasibility Summary Table for Caversham Park

- 10.12 The impact of the recommended ASHPs on the regulated carbon dioxide emissions of the proposed development have been modelled and are shown in table 12 below.

10.13 A sufficiently sized ASHP has been specified within each dwelling to achieve $\geq 35\%$ savings in regulated carbon dioxide. The SAP (2012) output worksheets are provided in Appendix A of this report. See Appendix B for further calculations using SAP 10 carbon emission factors.

	Carbon dioxide emissions (tonnes CO ₂ per annum)	Regulated carbon dioxide savings (%)
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.4	-
After energy demand reductions (be lean)	10.3	10%
After heat network connection (be clean)	9.9	3%
After renewable energy (be green)	7.3	23%
Total carbon dioxide savings (%)		36%

Table 12: Baseline, 'be lean', 'be clean' and 'be green' regulated carbon emissions

10.14 The 'be green' case demonstrates total carbon dioxide emissions of 7.3 tonnes CO₂ per annum. This is a 23% reduction in regulated carbon emissions against the 'be clean' case and a total carbon dioxide saving of 36%, thus meeting the requirements of Reading Borough Councils Local Plan.

11 CARBON OFFSETTING

- 11.1 The energy strategy outlined within this report demonstrates that the development achieves a total 36% reduction in carbon emissions using the SAP (2012) methodology and the Carbon Emissions Reporting Spreadsheet. Where a net-zero carbon outcome is not achieved the shortfall must be met through a cash-in-lieu contribution to the Boroughs Carbon Offset Fund.
- 11.2 The total remaining carbon emissions have been calculated and multiplied by the lifetime of the development to give the cumulative shortfall. This has then been multiplied by £60 (carbon dioxide offset price) to determine the required cash-in-lieu contribution.
- 11.3 The Carbon Reporting Spreadsheet has been completed which confirms the total cash-in-lieu contribution of £13,161. Calculation using SAP 10 carbon emission factors have also been completed, the full spreadsheet is included within Appendix B.

12 PART 2: SUSTAINABILITY

12.1 Resi Resolve has carried out a sustainability statement for the proposed development at Caversham Park to satisfy the key sustainability policies set out in the Reading Local Plan.

12.2 The Applicant is committed to making the fullest contribution to promoting sustainability across the development. Consideration has been made to the following areas of design and construction which will be explored within this statement:

- Maximising use of natural systems
- Conserving energy, materials, and water resources
- Reducing noise and pollution
- Ensuring developments are comfortable and accessible for users
- Conserving and enhancing the natural environment and biodiversity
- Sustainable construction and waste management

13 MAXIMISE USE OF NATURAL SYSTEMS

PRINCIPLES OF GOOD DESIGN

- 13.1 The Applicants proposed development at Caversham Park maximises the potential of the site and conforms to good design principles for the development of a compact urban extension. The proposals aim to create a new mixed-use settlement that reflects the predominant architectural character of the local area.
- 13.2 The energy demand and carbon dioxide emissions from the proposed dwellings will be minimised through careful design of the built form and services, with preference for a natural ventilation strategy rather than recourse to mechanical systems.

CLIMATE CHANGE MITIGATION

- 13.3 The proposed development at Caversham Park will incorporate a range of measures to mitigate for the anticipated impacts of climate change, thus complying with policy CC3: Adaptation to Climate Change. Full details on the following measures are provided throughout Part 1 and 2 of this report. In summary:
- Energy conservation and efficiency measures will be taken in the design and construction of the buildings to meet the Part L1A and L1B Building Regulations standard. This will include the specification of robust fabric standards, buildings orientated due south wherever practicable, and the sizing of windows to maximise passive solar gains and ensure adequate daylight.
 - Consideration to orientation and configuration of development to avoid contribution to urban heat island effect.
 - Energy efficient internal and external lighting throughout the scheme.
 - The incorporation of landscaped areas to promote sustainable drainage, urban cooling, and biodiversity enhancement. The creation of landscaping zones will also help to enhance the local microclimate and counter air pollution.
 - Deciduous trees which can bring solar shading in summer and promote sunlight penetration in winter are to be incorporated as an aspect of the landscape plan.
 - Utilisation of sustainable sanitary features to minimise water consumption across the site.

- The selection of materials for the buildings will be determined with reference to the BRE's Green Guide Specification. Preference will be given to materials with the lowest lifecycle impact for all the main building and finishing elements e.g., PEFC or FSC sourced timber, where viable.

14 CONSERVE ENERGY, MATERIAL AND WATER RESOURCES

ENERGY EFFICIENCY AND REDUCED DEMAND

- 14.1 The assessment of potential methods of conserving energy and the use of energy efficient and renewable energy technologies has been carried out within Part 1 of this report. The strategic approach to the design of the development has been to reduce carbon dioxide emissions in line with the energy hierarchy.

LOW CARBON AND RENEWABLE ENERGY SYSTEMS

- 14.2 An array of low carbon and renewable energy technologies have been considered in relation to the proposed development at Caversham Park. These comprise:

- Combined Heat and Power (CHP)
- Biomass
- Ground source heat pumps
- Air source heat pumps
- Solar thermal panels
- Wind turbines
- Solar photovoltaic panels

- 14.3 It is proposed that ASHPs represents the most viable solution for long term energy efficiency for the Caversham Park development.

MATERIAL PROCUREMENT

- 14.4 While a major consideration in materials selection is maintaining a distinct architectural style, from a sustainability perspective the Applicant is equally committed to minimising the environmental impact of the materials used over the lifetime of the building – from manufacture to eventual demolition, to disposal. For building materials, the Applicant will, wherever viable and practicable, specify 'A+ to D' rated materials using the online BRE Green Guide to Housing Specification.

- 14.5 Wherever feasible, the Applicant will commit to using materials that are locally sourced, are from renewable sources and are recycled e.g., secondary aggregates. The use of recycled

materials (e.g., crushed concrete from waste used for hard standing) has zero embodied energy impact, other than that expended in their processing or transport. Prior to demolition, the ICE's Demolition Protocol will be used to maximise the recycling of materials.

- 14.6 Timber used in the development for both basic and finishing elements will be sourced from sustainable European sources (e.g., PEFC or FSC).

WATER CONSUMPTION

- 14.7 The Applicant is committed to reducing water consumption in line with the higher water efficiency standard under Regulation 36(3) of the Building Regulations, thus complying with the Local Plan Policy H5: Standards for New Housing. The internal potable water consumption in all dwellings will be limited to not more than 110 litres per person per day. To meet these targets water efficient sanitary devices will be installed. The specification of such devices will be considered at the detailed design stage, and each will be subject to an evaluation based upon technical performance and market appeal, together with compliance with Part G of Building Regulations. The following devices will be assessed and, if viable, incorporated within each building unit:

- Spray/aerated/flow restricted taps
- Dual flush toilets
- Low output showers
- Reduced size baths to the point of overflow
- Water efficient white goods

WATER METERING

- 14.8 The Applicant proposes 100% water metering across the Caversham Park development. This will enable future residents and building occupants to closely monitor their consumption patterns.

RAINWATER HARVESTING FOR IRRIGATION

- 14.9 Drier summers, increased drought conditions and higher temperatures due to climate change are likely to reduce water supplies across all southern England over the next few decades. Beyond the water efficiency savings detailed above, the Applicant is committed to further

reducing mains water use at Caversham Park by incorporating rainwater harvesting facilities, appropriate to the land use, where viable. Water butts will be allocated to residential properties, facilitating the irrigation of soft landscaping without recourse to potable water supplies. Investigations into the viability and practicalities of grey water recycling will be carried out by a specialist.

CYCLE STORAGE

- 14.10 Adequately sized, secure and convenient cycle storage will be provided to promote the use of bicycles to further reduce the developments carbon footprint. The following cycle parking standards will be met:

Residential Use	No. of Beds	No. of Parking Spaces
C2 Nursing Home		1 per 3 staff
C3 Retirement Home with Warden (spaces per individual units)		1 per 3 staff / 1 space minimum
C3 Dwelling Flat	1-2	0.5
C3 Dwelling Flat	3+	1
C3 Dwelling House	1	1
C3 Dwelling House	2	2
C3 Dwelling House	3	2

- 14.11 It is confirmed that the 5 Market Dwelling (Class C3) and 28 Affordable Dwellings (Class C3) will achieve the above standards with individual cycle stores located in the rear gardens.

15 REDUCE POLLUTION

- 15.1 The Applicant is committed to reducing all forms of pollution and will consult with Policy EN15: Air Quality and Policy EN16: Pollution and Water Resources of Reading Borough Councils Local Plan to ensure compliance.

NOISE POLLUTION

- 15.2 The dwellings will be designed using Robust Details to facilitate a considerable enhancement on the acoustic standard required by Part E of Building Regulations. It is predicted that the development will achieve at least a 5dB improvement on the acoustic standards set by Building Regulations.

LIGHT POLLUTION

- 15.3 All external lighting will be of the dedicated energy efficient type. The lighting will be arranged so that it is all down-facing, and this will reduce the risk of light pollution. Daylight sensors and time controls will also be provided for all external lighting to ensure that it can be automatically switched off when not required.

AIR POLLUTION

- 15.4 Air intakes/outlets within the proposed buildings will avoid major sources of external pollution to avoid internal air pollution.
- 15.5 The Applicant will also adopt best practice procedures for minimising air and dust pollution on site. This is likely to take the form of wheel washing facilities and the sheeting of vehicles carrying waste materials off-site if there is any risk of dust blow.
- 15.6 Once the traffic generation potential of the extant use of the Site has been taken into consideration, the redevelopment would result in a significant reduction in the level of traffic that would be generated by the site. This translates to an insignificant increase in nitrogen dioxide emissions or increase in particulate matter emissions.

WATER POLLUTION

- 15.7 During the construction phase, the Applicant will adopt best practice procedures on site in relation to the potential for water pollution to comply with Policy EN16: Pollution and Water Resources. Detailed procedural guidance will be disseminated to site operatives and will be prepared in accordance with advice gleaned from PPG1, PPG5 and PPG6.

LAND AFFECTED BY CONTAMINATION

- 15.8 The existing site is not used for industrial or commercial purposes and is therefore considered unlikely to be affected by contamination, including:
- soils contaminated by chemicals
 - migration of contaminants to ground and surface waters; and
 - the production of hazardous gases
- 15.9 A separate soil investigation report will further amplify proposals and mitigation of any contamination.

POLLUTION FROM BUILDING MATERIALS

- 15.10 All insulating materials will have an Ozone Depleting Potential of Zero and a Global Warming Potential of less than 5. It is intended that the Caversham Park development will utilise low Volatile Organic Compounds. These are usually solvents that have the capacity to rapidly evaporate. Once airborne they cause chemical or photochemical reactions in the atmosphere leading to the formation of smog containing, amongst other things, ground level ozone and can produce several physical problems such as eye and skin irritation, lung and breathing problems, headaches, nausea, and muscle weakness. Preference will also be given to the specification of inert materials as they are non-toxic and easily re-used or recycled.
- 15.11 The design of the buildings will avoid the use of CFCs or HCFCs in their insulation, air-conditioning (if installed) and firefighting proposals. Plans will be formulated by the Applicant to avoid sickness, contamination of watercourses/extraction points and other risks to health and safety of people in or around the buildings.

16 FLOOD RISK AND SUSTAINABLE DRAINAGE

- 16.1 Although the proposed development at Caversham Park already has a low risk of flooding as determined by the Environment Agency's online flood mapping analysis, the Applicant will consider all potential options for the incorporation of Sustainable Urban Drainage Systems (SuDS) in line with the Government's Technical Standards, thus complying with Policy EN18: Flooding and Sustainable Drainage Systems.
- 16.2 The SuDS provision will consider all possibilities to maximise ecological benefits such as incorporating tree planting and landscaping.
- 16.3 Environment Agency guidelines require that surface water be disposed of by means of a soakaway. All surface water runoff rates post development will be no more than their pre-development counterparts for all storm incidences up to and including the 1 in 100-year event, including an allowance for climate change.
- 16.4 A Flood Risk Assessment and Drainage Strategy has been prepared by Glanville.

17 HEALTH AND WELL-BEING

DESIGNING INCLUSIVE ENVIRONMENTS

17.1 The proposed development will adhere to principles of inclusive design. The following measures will be introduced to ensure that those with mobility difficulties can access all areas of the development:

- A pedestrian friendly environment
- Step free entrance access to the proposed block
- Pavements with tactile surfacing
- Carefully designed landscaping.

17.2 The Applicant's commitment to inclusivity will be demonstrated through their attitude towards movement and equality. The Applicant will ensure that the development is scaled appropriately to respond to the needs of all its users. They will incorporate the requirements of the Disability Discrimination Act (1995) into their design, making reasonable adjustments to enable disabled access, regularly reviewing whether the buildings are accessible and effective, and providing necessary design adjustments where it is practicable to do so.

17.3 At least 5% of dwellings will be wheelchair user dwellings in line with M4(3) of the Building Regulations. All other dwellings will be designed to nationally described space standards, thus complying with Policy H5: Standards for New Housing.

PRIVATE SPACE

17.4 The Applicant is dedicated to provided adequate external garden space to the dwellings.

17.5 The Applicant is committed to providing appropriate provisions of open space which meet the needs of the development. The requirements of Policy EN9: Provision of Open Space will be consulted with and applied aptly across the development.

SECURITY

17.6 An Architectural Liaison Officer (ALO) or Crime Prevention Design Advisor (CPDA) from the local police force will be consulted at the design stage and their recommendations

incorporated into the design of the development. This is help ensure that all occupants feel safe and secure and where crime and disorder, or the fear of crime, does not undermine quality of life or community cohesion.

COMFORTABLE LIVING

- 17.7 The internal climate associated with all buildings within the development will be typified by good daylight levels, high levels of insulation to ensure thermal comfort, a high number of openable windows for natural ventilation and an easily understood heating system.

NOISE

- 17.8 The dwellings will be designed using Robust Details to facilitate a considerable enhancement on the acoustic standard required by Part E of Building Regulations. It is predicted that the development will achieve at least a 5dB improvement on the acoustic standards set by Building Regulations.

18 CONSERVE AND ENHANCE THE NATURAL ENVIRONMENT AND BIODIVERSITY

- 18.1 The Applicant is committed to minimising the impact of the development on the site and the surrounding ecology. Any ecological features defined to have ecological value will be retained and protected during the construction phase.
- 18.2 The biodiversity and ecology of the site is considered and amplified by a separate report. The report shall investigate potential constraints of development for the site and identify the presence of any protected plant or animal species.
- 18.3 To mitigate the potential impact of the scheme and to enhance the sites existing biodiversity, where feasible, recommendations from a suitably qualified ecologist will be considered.

19 SUSTAINABLE CONSTRUCTION AND WASTE MANAGEMENT

- 19.1 The Applicant is committed to identify measures to minimise the generation of waste and to handle waste appropriately during the lifetime of the development, thus complying with Policy CC5: Waste Minimisation and Storage. The Council's Waste Minimisation Strategy has been reviewed and the Applicant is determined to achieve all aims within the strategy.
- 19.2 The Resources and Waste Strategy Policy Paper will be consulted to future-proof plans for the development.
- 19.3 The Applicant will adopt best practice procedures and ensure that appropriate measures are taken. For example:
- Appropriate transportation of waste
 - Re-use of demolition and building waste
 - Re-use and refurbish buildings where possible
 - Promoting the use of recycled and secondary aggregates
 - Reduce/remove over ordering of building material.
- 19.4 A Site Waste Management Plan (SWMP) will be developed to inform the adoption of good practice waste minimisation in design.
- 19.5 The Applicant's detailed proposals allocate sufficient space within the proposed bin store for general refuse and recyclable waste bins. All waste containers will be sited on a hard, level surface that is fully accessible to wheelchair users.
- 19.6 To help encourage and promote domestic recycling, the Applicant will endeavour to provide dwellings, where practical, with three internal waste bins in a kitchen cupboard adjacent to the sink. These will have a total capacity of at least 30 litres and will enable the segregation of various recyclable waste streams. A Home User Guide will be provided to each dwelling will describe the waste services provided by Reading Borough Council. The guide will provide further information as well as guidance on reducing and recycling waste.
- 19.7 Site waste generated in the construction of the development will be managed to both limit the amount of waste generated and to recycle or re-use any waste that is generated by the development, where possible. National Policy, such as the Landfill Directive, will be followed.

- 19.8 Dwellings within the Caversham Park development will have access to a communal composting facility within the communal gardens.

20 BEEHCROFT HEALTHIHOUSE

20.1 A Beechcroft Healthihouse is designed, constructed, and finished so that it is conducive to good health. The essential elements of a Beechcroft Healthihouse are as follows:

- Whole house ventilation system which provides filtered air to all living rooms, this ensures a healthier and comfortable environment by removing odours, aiding respiration, and keeping temperatures consistent.
- Kitchen taps fitted with a water filtration system which reduces limescale, organic impurities, chlorine, and metals.
- Copper light-switches and door handles which anti-microbial properties that can naturally kill bacteria within hours.
- Kitchen, bathrooms, en-suites, and utility rooms have easy-clean, hygienic, non-porous Silestone work surfaces with built-in antimicrobial protection to fight the spread of bacteria, mould, and mildew.
- Basins, WC seats and covers are hygienic, easy-to-clean, and incorporate technology designed to reduce/suppress bacteria and mould growth by up to 99.9%.
- Bathroom wall panelling are hygienic and easy-to-clean which provides a safe alternative to tiling and without the need for grout which may absorb bacteria and promote mould growth.
- Homes are deep cleaned to World Health Organisation standards prior to move in.

21 BREEAM

- 21.1 A BREEAM Assessment will be prepared by a BREEAM Accredited Professional for the 64-bed care home. Please refer to the BREEAM Assessment for further information.

22 CONCLUSION

- 22.1 This Energy and Sustainability Strategy describes the approach at the proposed Caversham Park development. The described approach will enable the Applicant to create a high standard sustainable development in accordance with the sustainability requirements of Policy CC2, CC3, CC4, CC5, EN18 and H5 of the Reading Borough Councils Local Plan (Adopted November 2019).
- 22.2 The proposals within this Strategy demonstrate a 36% reduction in regulated carbon dioxide emissions of the proposed new dwellings at the Caversham Park development. This exceeds the 35% reduction target. The remaining carbon emissions will be achieved through off site solutions and a cash-in-lieu contribution to the Boroughs Carbon Offset Fund.
- 22.3 The refurbished dwellings incorporate enhanced u-values which will provide an average overall improvement of 29% against the requirements of Approved Document Part L1B of the Building Regulations. The heating and hot water specification will mirror that of the new build.
- 22.4 The care home will achieve the required BREEAM rating and is amplified by a separate report.
- 22.5 All dwellings will be designed and constructed with the issue of climate change and its anticipated impacts being considered within the Masterplan, which includes appropriate mitigation measures for issues such as preventing internal overheating. The energy (SAP) calculations demonstrate a 'not significant' overheating risk.
- 22.6 Cost saving benefits for the future residents and users will occur because of energy efficient and well insulated buildings. This strategy is geared towards reducing energy consumption using highly efficient heat sources, coupled with high levels of insulation, enhanced energy efficient measures and renewable technology.
- 22.7 The proposed approach detailed in this Energy and Sustainability Strategy will ensure that the key sustainability policies of Reading Borough Councils Local Plan will be met with consideration made to the following areas of design and construction:
- Energy Efficiency Measures
 - Sustainable Design and Layout
 - Water Resource Management

- Material Resource Management
- Biodiversity
- Sustainable Construction and reducing pollution.

APPENDIX A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 01 AFF				Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (AFF/01)	Prop Type Ref	TYPE AFF / 2 BED / 2 STOREY			
Property	TYPE AFF / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	84 B	DER	17.23	TER	18.82	
Environmental	87 B	% DER<TER	8.46			
CO ₂ Emissions (t/year)	1.13	DFEE	42.88	TFEE	52.85	
General Requirements Compliance	Pass	% DFEE<TFEE	18.86			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 79 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 18.82 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 17.23 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 42.9 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 30

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: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:

Average

Windows facing North: 3.38 m², No overhang

Windows facing South: 7.19 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.2720 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1577 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4077 (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) =	0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (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
WINDOW (Uw = 1.30)			10.5700	1.2357	13.0618		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			39.6400	0.1100	4.3604		(28a)
External Wall 1	126.1000	12.6300	113.4700	0.2000	22.6940		(29a)
External Roof 1	39.6400		39.6400	0.1000	3.9640		(30)
Total net area of external elements Aum(A, m ²)			205.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1402		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							7.1883 (36)
Total fabric heat loss						(33) + (36) =	53.3285 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	37.5231	37.2851	37.0519	35.9563	35.7513	34.7971	34.7971	34.6204	35.1646	35.7513	36.1660	36.5995 (38)
Heat transfer coeff	90.8516	90.6136	90.3803	89.2848	89.0798	88.1256	88.1256	87.9489	88.4931	89.0798	89.4945	89.9280 (39)
Average = Sum(39)m / 12 =												89.2838 (39)
HLP	1.1460	1.1430	1.1400	1.1262	1.1236	1.1116	1.1116	1.1093	1.1162	1.1236	1.1288	1.1343 (40)
HLP (average)												1.1262 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
Daily hot water use	101.6016	97.9070	94.2124	90.5178	86.8232	83.1286	83.1286	86.8232	90.5178	94.2124	97.9070	101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)										Total = Sum(45)m =		1453.2630 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (46)
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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
	14.6689	13.2281	14.6013	14.0802	14.5132	14.0031	14.4438	14.4888	14.0451	14.5648	14.1530	14.6547 (61)
Total heat required for water heating calculated for each month												
Solar input	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727 (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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				1624.7081 (64)
	53.7658	47.1235	48.8650	42.9393	41.4520	36.1398	33.8558	38.3286	38.6322	44.5712	48.2166	52.1814 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453 (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)												
	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623 (71)
Water heating gains (Table 5)												
	72.2658	70.1243	65.6788	59.6380	55.7151	50.1941	45.5051	51.5169	53.6558	59.9076	66.9674	70.1363 (72)
Total internal gains												
	373.9985	371.7629	358.1243	336.2546	314.1086	292.8529	279.1338	285.2398	296.5718	318.6523	343.9354	362.8390 (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					3.3800	10.6334	0.4500	0.0000	0.7700		12.4535 (74)	
South					7.1900	46.7521	0.4500	0.0000	0.7700		116.4751 (78)	
Solar gains	128.9286	214.5554	283.4303	339.5892	373.6871	369.0881	356.5528	330.7150	302.4542	234.0783	153.4257	111.0270 (83)
Total gains	502.9271	586.3183	641.5545	675.8438	687.7957	661.9410	635.6866	615.9547	599.0259	552.7307	497.3611	473.8660 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.5995	60.7586	60.9154	61.6629	61.8048	62.4740	62.4740	62.5995	62.2145	61.8048	61.5184	61.2218
alpha	5.0400	5.0506	5.0610	5.1109	5.1203	5.1649	5.1649	5.1733	5.1476	5.1203	5.1012	5.0815
util living area												
	0.9974	0.9940	0.9861	0.9639	0.9037	0.7642	0.5905	0.6291	0.8452	0.9701	0.9944	0.9981 (86)
MIT	19.7960	19.9608	20.1955	20.4897	20.7537	20.9306	20.9853	20.9796	20.8757	20.5355	20.1088	19.7671 (87)
Th 2	19.9635	19.9659	19.9683	19.9795	19.9816	19.9914	19.9914	19.9932	19.9876	19.9816	19.9773	19.9729 (88)
util rest of house												
	0.9966	0.9920	0.9811	0.9499	0.8645	0.6758	0.4650	0.5050	0.7739	0.9557	0.9921	0.9975 (89)
MIT 2	18.8706	19.0365	19.2707	19.5664	19.8112	19.9582	19.9875	19.9873	19.9191	19.6156	19.1937	18.8493 (90)
Living area fraction									fLA = Living area / (4) =			0.2354 (91)
MIT	19.0885	19.2541	19.4883	19.7837	20.0330	20.1871	20.2224	20.2209	20.1443	19.8321	19.4091	19.0653 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.9385	19.1041	19.3383	19.6337	19.8830	20.0371	20.0724	20.0709	19.9943	19.6821	19.2591	18.9153 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9954	0.9896	0.9771	0.9439	0.8599	0.6802	0.4756	0.5152	0.7744	0.9501	0.9899	0.9965 (94)
Useful gains	500.5941	580.2480	626.8546	637.9266	591.4446	450.2818	302.3270	317.3120	463.8925	525.1562	492.3428	472.2156 (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												
	1329.9261	1287.0803	1160.3340	958.3548	728.9432	479.1482	306.0036	322.8484	521.6035	809.0332	1088.1689	1323.3209 (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												
	617.0230	474.9913	396.9086	230.7082	102.2990	0.0000	0.0000	0.0000	0.0000	211.2044	428.9948	633.2224 (98)
Space heating												3095.3518 (98)
Space heating per m2										(98) / (4) =		39.0433 (99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3420.2782 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	617.0230	474.9913	396.9086	230.7082	102.2990	0.0000	0.0000	0.0000	0.0000	211.2044	428.9948	633.2224	(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)	681.7934	524.8523	438.5731	254.9262	113.0376	0.0000	0.0000	0.0000	0.0000	233.3751	474.0274	699.6932	(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	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727	(64)
Efficiency of water heater	89.8043	89.7307	89.5967	89.3050	88.6914	87.3000	87.3000	87.3000	87.3000	89.2097	89.6548	89.8339	(217)
Fuel for water heating, kWh/month	184.1128	161.6025	168.0702	148.5184	144.6237	128.4828	120.7396	136.1614	137.0812	154.3136	165.6618	178.7440	(219)
Water heating fuel used												1828.1120	(219)
Annual totals kWh/year													
Space heating fuel - main system												3420.2782	(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)												372.0620	(232)
Total delivered energy for all uses												5695.4522	(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	3420.2782	0.2160	738.7801 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.1120	0.2160	394.8722 (264)
Space and water heating			1133.6523 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/year			1365.6775 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2300 (273)

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

DER		17.2300	ZC1
Total Floor Area	TFA	79.2800	
Assumed number of occupants	N	2.4491	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2891	ZC2
CO2 emissions from cooking, equation (L16)		2.2424	ZC3
Total CO2 emissions		35.7615	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		35.7615	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	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.2720 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1577 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4077 (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) =					0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072	(22b)				
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			10.5700	1.3258	14.0133		(27)					
Heat Loss Floor 1			39.6400	0.1300	5.1532		(28a)					
External Wall 1	126.1000	12.6300	113.4700	0.1800	20.4246		(29a)					
External Roof 1	39.6400		39.6400	0.1300	5.1532		(30)					
Total net area of external elements Aum(A, m2)			205.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8043		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0364 (36)					
Total fabric heat loss						(33) + (36) =	55.8407 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.5231	Feb 37.2851	Mar 37.0519	Apr 35.9563	May 35.7513	Jun 34.7971	Jul 34.7971	Aug 34.6204	Sep 35.1646	Oct 35.7513	Nov 36.1660	Dec 36.5995 (38)
Heat transfer coeff	93.3637	93.1258	92.8925	91.7969	91.5920	90.6377	90.6377	90.4610	91.0053	91.5920	92.0066	92.4401 (39)
Average = Sum(39)m / 12 =												91.7959 (39)
HLP	Jan 1.1776	Feb 1.1746	Mar 1.1717	Apr 1.1579	May 1.1553	Jun 1.1433	Jul 1.1433	Aug 1.1410	Sep 1.1479	Oct 1.1553	Nov 1.1605	Dec 1.1660 (40)
HLP (average)												1.1579 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
Daily hot water use	Jan 101.6016	Feb 97.9070	Mar 94.2124	Apr 90.5178	May 86.8232	Jun 83.1286	Jul 83.1286	Aug 86.8232	Sep 90.5178	Oct 94.2124	Nov 97.9070	Dec 101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)										Total = Sum(45)m =		1453.2630 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (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 TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	45.0641	48.0096	44.6389	44.2442	40.9949	42.3614	44.2442	44.6389	48.0096	48.2829	50.9589 (61)
Solar input	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770 (64)
	62.8383	55.0825	57.2171	50.5790	48.8848	42.8877	40.8352	45.7674	46.2806	52.9324	56.7490	61.2575 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	(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)	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	(71)
Water heating gains (Table 5)	84.4600	81.9680	76.9047	70.2486	65.7053	59.5663	54.8860	61.5154	64.2786	71.1457	78.8181	82.3353	(72)
Total internal gains	386.1928	383.6066	369.3502	346.8653	324.0988	302.2251	288.5147	295.2382	307.1946	329.8905	355.7861	375.0380	(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					3.3800	10.6334	0.6300	0.7000	0.7700	10.9840 (74)		
South					7.1900	46.7521	0.6300	0.7000	0.7700	102.7310 (78)		
Solar gains	113.7150	189.2379	249.9855	299.5177	329.5921	325.5357	314.4796	291.6906	266.7646	206.4571	135.3214	97.9258 (83)
Total gains	499.9077	572.8445	619.3357	646.3829	653.6909	627.7608	602.9943	586.9288	573.9592	536.3476	491.1075	472.9638 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.9689	59.1196	59.2680	59.9754	60.1096	60.7424	60.7424	60.8611	60.4971	60.1096	59.8387	59.5581	
alpha	4.9313	4.9413	4.9512	4.9984	5.0073	5.0495	5.0495	5.0574	5.0331	5.0073	4.9892	4.9705	
util living area	0.9975	0.9947	0.9884	0.9709	0.9224	0.8001	0.6311	0.6676	0.8694	0.9746	0.9948	0.9981	(86)
MIT	19.7500	19.9038	20.1330	20.4285	20.7055	20.9077	20.9784	20.9712	20.8472	20.4913	20.0655	19.7232	(87)
Th 2	19.9379	19.9403	19.9427	19.9538	19.9559	19.9657	19.9657	19.9675	19.9619	19.9559	19.9517	19.9473	(88)
util rest of house	0.9967	0.9928	0.9841	0.9592	0.8879	0.7136	0.4978	0.5375	0.8023	0.9619	0.9927	0.9975	(89)
MIT 2	18.2776	18.5034	18.8380	19.2700	19.6513	19.8990	19.9571	19.9549	19.8352	19.3648	18.7483	18.2451	(90)
Living area fraction	18.6241	18.8330	19.1428	19.5426	19.8994	20.1364	20.1975	20.1941	20.0734	19.6300	19.0583	18.5930	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6241	18.8330	19.1428	19.5426	19.8994	20.1364	20.1975	20.1941	20.0734	19.6300	19.0583	18.5930	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	497.4561	567.1703	606.7382	616.0916	578.9343	458.0084	319.1859	333.3856	465.3621	513.0678	486.2088	471.1762	(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	1337.3545	1297.5223	1174.4186	976.9625	750.9993	501.8064	326.0691	343.2159	543.6130	827.0720	1100.2445	1330.4938	(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	624.8844	490.7965	422.3542	259.8270	128.0164	0.0000	0.0000	0.0000	0.0000	233.6191	442.1057	639.3323	(98)
Space heating												3240.9357	(98)
Space heating per m2												40.8796	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3469.9525 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	624.8844	490.7965	422.3542	259.8270	128.0164	0.0000	0.0000	0.0000	0.0000	233.6191	442.1057	639.3323	(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)	669.0411	525.4781	452.1994	278.1874	137.0625	0.0000	0.0000	0.0000	0.0000	250.1275	473.3466	684.5100	(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	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770	(64)
Efficiency of water heater (217)m	87.7087	87.4853	87.0766	86.2165	84.5269	80.3000	80.3000	80.3000	80.3000	85.8356	87.1937	87.8000	(217)
Fuel for water heating, kWh/month	229.8872	202.1401	211.3011	189.2829	186.9224	173.2968	166.0316	185.0863	187.1304	199.3431	209.4805	224.2336	(219)
Water heating fuel used												2364.1360	(219)
Annual totals kWh/year													
Space heating fuel - main system												3469.9525	(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)												372.0620	(232)
Total delivered energy for all uses												6281.1505	(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	3469.9525	0.2160	749.5097 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2364.1360	0.2160	510.6534 (264)
Space and water heating			1260.1631 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/m2/year			1492.1883 (272)
Emissions per m2 for space and water heating			15.8951 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4357 (272b)
Emissions per m2 for pumps and fans			0.4910 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8951 * 1.00) + 2.4357 + 0.4910, rounded to 2 d.p.			18.8200 (273)

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Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 01 AFF				Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (AFF/01)	Prop Type Ref	TYPE AFF / 2 BED / 2 STOREY			
Property	TYPE AFF / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	84 B	DER	16.62	TER	18.82	
Environmental	87 B	% DER<TER	11.70			
CO ₂ Emissions (t/year)	1.10	DFEE	42.88	TFEE	52.85	
General Requirements Compliance	Pass	% DFEE<TFEE	18.86			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 79 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.82 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.62 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.9 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.38 m², No overhang
Windows facing South: 7.19 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging ψ -value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.2720 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1577 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4077 (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) =	0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (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
WINDOW (Uw = 1.30)			10.5700	1.2357	13.0618		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			39.6400	0.1100	4.3604		(28a)
External Wall 1	126.1000	12.6300	113.4700	0.2000	22.6940		(29a)
External Roof 1	39.6400		39.6400	0.1000	3.9640		(30)
Total net area of external elements Aum(A, m ²)			205.3800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1402		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							7.1883 (36)
Total fabric heat loss						(33) + (36) =	53.3285 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	37.5231	37.2851	37.0519	35.9563	35.7513	34.7971	34.7971	34.6204	35.1646	35.7513	36.1660	36.5995 (38)
Heat transfer coeff	90.8516	90.6136	90.3803	89.2848	89.0798	88.1256	88.1256	87.9489	88.4931	89.0798	89.4945	89.9280 (39)
Average = Sum(39)m / 12 =												89.2838 (39)
HLP	1.1460	1.1430	1.1400	1.1262	1.1236	1.1116	1.1116	1.1093	1.1162	1.1236	1.1288	1.1343 (40)
HLP (average)												1.1262 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
Daily hot water use	101.6016	97.9070	94.2124	90.5178	86.8232	83.1286	83.1286	86.8232	90.5178	94.2124	97.9070	101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)										Total = Sum(45)m =		1453.2630 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (46)
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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.6689	13.2281	14.6013	14.0802	14.5132	14.0031	14.4438	14.4888	14.0451	14.5648	14.1530	14.6547 (61)
Solar input	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727 (64)
	53.7658	47.1235	48.8650	42.9393	41.4520	36.1398	33.8558	38.3286	38.6322	44.5712	48.2166	52.1814 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	(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)	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	(71)
Water heating gains (Table 5)	72.2658	70.1243	65.6788	59.6380	55.7151	50.1941	45.5051	51.5169	53.6558	59.9076	66.9674	70.1363	(72)
Total internal gains	373.9985	371.7629	358.1243	336.2546	314.1086	292.8529	279.1338	285.2398	296.5718	318.6523	343.9354	362.8390	(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					3.3800	10.6334	0.4500	0.0000			0.7700			12.4535
South					7.1900	46.7521	0.4500	0.0000			0.7700			116.4751 (74)
Solar gains	128.9286	214.5554	283.4303	339.5892	373.6871	369.0881	356.5528	330.7150	302.4542	234.0783	153.4257	111.0270 (83)		
Total gains	502.9271	586.3183	641.5545	675.8438	687.7957	661.9410	635.6866	615.9547	599.0259	552.7307	497.3611	473.8660 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.5995	60.7586	60.9154	61.6629	61.8048	62.4740	62.4740	62.5995	62.2145	61.8048	61.5184	61.2218	
alpha	5.0400	5.0506	5.0610	5.1109	5.1203	5.1649	5.1649	5.1733	5.1476	5.1203	5.1012	5.0815	
util living area	0.9974	0.9940	0.9861	0.9639	0.9037	0.7642	0.5905	0.6291	0.8452	0.9701	0.9944	0.9981	(86)
MIT	19.7960	19.9608	20.1955	20.4897	20.7537	20.9306	20.9853	20.9796	20.8757	20.5355	20.1088	19.7671	(87)
Th 2	19.9635	19.9659	19.9683	19.9795	19.9816	19.9914	19.9914	19.9932	19.9876	19.9816	19.9773	19.9729	(88)
util rest of house	0.9966	0.9920	0.9811	0.9499	0.8645	0.6758	0.4650	0.5050	0.7739	0.9557	0.9921	0.9975	(89)
MIT 2	18.3629	18.6046	18.9465	19.3744	19.7320	19.9428	19.9857	19.9846	19.8873	19.4456	18.8295	18.3273	(90)
Living area fraction	18.7002	18.9238	19.2405	19.6369	19.9725	20.1753	20.2210	20.2188	20.1200	19.7021	19.1306	18.6662	(91)
MIT	18.7002	18.9238	19.2405	19.6369	19.9725	20.1753	20.2210	20.2188	20.1200	19.7021	19.1306	18.6662	(92)
Temperature adjustment	18.5502	18.7738	19.0905	19.4869	19.8225	20.0253	20.0710	20.0688	19.9700	19.5521	18.9806	18.5162	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	500.2986	579.6095	625.6688	636.0426	589.4749	449.5256	302.2136	317.1437	462.6863	523.6847	491.8176	471.9969	(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	1294.6515	1257.1591	1137.9330	945.2496	723.5503	478.1105	305.8825	322.6637	519.4506	797.4502	1063.2511	1287.4228	(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	590.9986	455.3133	381.1245	222.6290	99.7521	0.0000	0.0000	0.0000	0.0000	203.6815	411.4321	606.6769	(98)
Space heating												2971.6080	(98)
Space heating per m2												37.4824	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3198.7169 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	590.9986	455.3133	381.1245	222.6290	99.7521	0.0000	0.0000	0.0000	0.0000	203.6815	411.4321	606.6769	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	636.1664	490.1112	410.2524	239.6437	107.3757	0.0000	0.0000	0.0000	0.0000	219.2481	442.8763	653.0429	(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	165.3412	145.0071	150.5853	132.6344	128.2688	112.1655	105.4057	118.8689	119.6719	137.6626	148.5238	160.5727	(64)
Efficiency of water heater (217)m	89.7806	89.7057	89.5702	89.2782	88.6716	87.3000	87.3000	87.3000	87.3000	89.1816	89.6286	89.8110	(217)
Fuel for water heating, kWh/month	184.1614	161.6475	168.1200	148.5630	144.6560	128.4828	120.7396	136.1614	137.0812	154.3621	165.7104	178.7895	(219)
Water heating fuel used												1828.4749	(219)
Annual totals kWh/year													
Space heating fuel - main system												3198.7169	(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)												372.0620	(232)
Total delivered energy for all uses												5474.2538	(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	3198.7169	0.2160	690.9229 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1828.4749	0.2160	394.9506 (264)
Space and water heating			1085.8734 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/year			1317.8986 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6200 (273)

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

DER		16.6200	ZC1
Total Floor Area	TFA	79.2800	
Assumed number of occupants	N	2.4491	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.2891	ZC2
CO2 emissions from cooking, equation (L16)		2.2424	ZC3
Total CO2 emissions		35.1515	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		35.1515	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	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.2720 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1577 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4077 (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) =	0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072 (22b)
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			10.5700	1.3258	14.0133		(27)					
Heat Loss Floor 1			39.6400	0.1300	5.1532		(28a)					
External Wall 1	126.1000	12.6300	113.4700	0.1800	20.4246		(29a)					
External Roof 1	39.6400		39.6400	0.1300	5.1532		(30)					
Total net area of external elements Aum(A, m2)			205.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.8043		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0364 (36)					
Total fabric heat loss						(33) + (36) =	55.8407 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.5231	Feb 37.2851	Mar 37.0519	Apr 35.9563	May 35.7513	Jun 34.7971	Jul 34.7971	Aug 34.6204	Sep 35.1646	Oct 35.7513	Nov 36.1660	Dec 36.5995 (38)
Heat transfer coeff	93.3637	93.1258	92.8925	91.7969	91.5920	90.6377	90.6377	90.4610	91.0053	91.5920	92.0066	92.4401 (39)
Average = Sum(39)m / 12 =												91.7959 (39)
HLP	Jan 1.1776	Feb 1.1746	Mar 1.1717	Apr 1.1579	May 1.1553	Jun 1.1433	Jul 1.1433	Aug 1.1410	Sep 1.1479	Oct 1.1553	Nov 1.1605	Dec 1.1660 (40)
HLP (average)												1.1579 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
Daily hot water use	Jan 101.6016	Feb 97.9070	Mar 94.2124	Apr 90.5178	May 86.8232	Jun 83.1286	Jul 83.1286	Aug 86.8232	Sep 90.5178	Oct 94.2124	Nov 97.9070	Dec 101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)										Total = Sum(45)m =		1453.2630 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (46)
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 TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	45.0641	48.0096	44.6389	44.2442	40.9949	42.3614	44.2442	44.6389	48.0096	48.2829	50.9589 (61)
Solar input	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770 (64)
	62.8383	55.0825	57.2171	50.5790	48.8848	42.8877	40.8352	45.7674	46.2806	52.9324	56.7490	61.2575 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	(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)	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	(71)
Water heating gains (Table 5)	84.4600	81.9680	76.9047	70.2486	65.7053	59.5663	54.8860	61.5154	64.2786	71.1457	78.8181	82.3353	(72)
Total internal gains	386.1928	383.6066	369.3502	346.8653	324.0988	302.2251	288.5147	295.2382	307.1946	329.8905	355.7861	375.0380	(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					3.3800	10.6334	0.6300	0.7000	0.7700	10.9840 (74)		
South					7.1900	46.7521	0.6300	0.7000	0.7700	102.7310 (78)		
Solar gains	113.7150	189.2379	249.9855	299.5177	329.5921	325.5357	314.4796	291.6906	266.7646	206.4571	135.3214	97.9258 (83)
Total gains	499.9077	572.8445	619.3357	646.3829	653.6909	627.7608	602.9943	586.9288	573.9592	536.3476	491.1075	472.9638 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	58.9689	59.1196	59.2680	59.9754	60.1096	60.7424	60.7424	60.8611	60.4971	60.1096	59.8387	59.5581	
alpha	4.9313	4.9413	4.9512	4.9984	5.0073	5.0495	5.0495	5.0574	5.0331	5.0073	4.9892	4.9705	
util living area	0.9975	0.9947	0.9884	0.9709	0.9224	0.8001	0.6311	0.6676	0.8694	0.9746	0.9948	0.9981	(86)
MIT	19.7500	19.9038	20.1330	20.4285	20.7055	20.9077	20.9784	20.9712	20.8472	20.4913	20.0655	19.7232	(87)
Th 2	19.9379	19.9403	19.9427	19.9538	19.9559	19.9657	19.9657	19.9675	19.9619	19.9559	19.9517	19.9473	(88)
util rest of house	0.9967	0.9928	0.9841	0.9592	0.8879	0.7136	0.4978	0.5375	0.8023	0.9619	0.9927	0.9975	(89)
MIT 2	18.2776	18.5034	18.8380	19.2700	19.6513	19.8990	19.9571	19.9549	19.8352	19.3648	18.7483	18.2451	(90)
Living area fraction	18.6241	18.8330	19.1428	19.5426	19.8994	20.1364	20.1975	20.1941	20.0734	19.6300	19.0583	18.5930	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6241	18.8330	19.1428	19.5426	19.8994	20.1364	20.1975	20.1941	20.0734	19.6300	19.0583	18.5930	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	497.4561	567.1703	606.7382	616.0916	578.9343	458.0084	319.1859	333.3856	465.3621	513.0678	486.2088	471.1762	(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	1337.3545	1297.5223	1174.4186	976.9625	750.9993	501.8064	326.0691	343.2159	543.6130	827.0720	1100.2445	1330.4938	(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	624.8844	490.7965	422.3542	259.8270	128.0164	0.0000	0.0000	0.0000	0.0000	233.6191	442.1057	639.3323	(98)
Space heating												3240.9357	(98)
Space heating per m2												40.8796	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3469.9525 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	624.8844	490.7965	422.3542	259.8270	128.0164	0.0000	0.0000	0.0000	0.0000	233.6191	442.1057	639.3323	(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)	669.0411	525.4781	452.1994	278.1874	137.0625	0.0000	0.0000	0.0000	0.0000	250.1275	473.3466	684.5100	(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	201.6312	176.8430	183.9937	163.1931	157.9997	139.1574	133.3233	148.6243	150.2657	171.1074	182.6538	196.8770	(64)
Efficiency of water heater (217)m	87.7087	87.4853	87.0766	86.2165	84.5269	80.3000	80.3000	80.3000	80.3000	85.8356	87.1937	87.8000	(217)
Fuel for water heating, kWh/month	229.8872	202.1401	211.3011	189.2829	186.9224	173.2968	166.0316	185.0863	187.1304	199.3431	209.4805	224.2336	(219)
Water heating fuel used												2364.1360	(219)
Annual totals kWh/year													
Space heating fuel - main system												3469.9525	(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)												372.0620	(232)
Total delivered energy for all uses												6281.1505	(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	3469.9525	0.2160	749.5097 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2364.1360	0.2160	510.6534 (264)
Space and water heating			1260.1631 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/m2/year			1492.1883 (272)
Emissions per m2 for space and water heating			15.8951 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4357 (272b)
Emissions per m2 for pumps and fans			0.4910 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8951 * 1.00) + 2.4357 + 0.4910, rounded to 2 d.p.			18.8200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 01 AFF				Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (AFF/01)	Prop Type Ref	TYPE AFF / 2 BED / 2 STOREY			
Property	TYPE AFF / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	88 B	DER	13.81	TER	27.03	
Environmental	89 B	% DER<TER	48.92			
CO ₂ Emissions (t/year)	0.93	DFEE	42.88	TFEE	52.85	
General Requirements Compliance	Pass	% DFEE<TFEE	18.86			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 79 m²

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

1a TER and DER

Fuel for main heating: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 27.03 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.81 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 42.9 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.11 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
-------------------------	-----------------------------------	----

Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	3.38 m ² , No overhang
Windows facing South:	7.19 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging ψ -value	0.035 W/m ² K

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	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	190.2720 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1577 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4077 (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) =					0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072	(22b)				
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(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					
WINDOW (Uw = 1.30)			10.5700	1.2357	13.0618		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			39.6400	0.1100	4.3604		(28a)					
External Wall 1	126.1000	12.6300	113.4700	0.2000	22.6940		(29a)					
External Roof 1	39.6400		39.6400	0.1000	3.9640		(30)					
Total net area of external elements Aum(A, m2)			205.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1402		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							7.1883 (36)					
Total fabric heat loss						(33) + (36) =	53.3285 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.5231	Feb 37.2851	Mar 37.0519	Apr 35.9563	May 35.7513	Jun 34.7971	Jul 34.7971	Aug 34.6204	Sep 35.1646	Oct 35.7513	Nov 36.1660	Dec 36.5995 (38)
Heat transfer coeff	90.8516	90.6136	90.3803	89.2848	89.0798	88.1256	88.1256	87.9489	88.4931	89.0798	89.4945	89.9280 (39)
Average = Sum(39)m / 12 =												89.2838 (39)
HLP	Jan 1.1460	Feb 1.1430	Mar 1.1400	Apr 1.1262	May 1.1236	Jun 1.1116	Jul 1.1116	Aug 1.1093	Sep 1.1162	Oct 1.1236	Nov 1.1288	Dec 1.1343 (40)
HLP (average)												1.1262 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.6016	97.9070	94.2124	90.5178	86.8232	83.1286	83.1286	86.8232	90.5178	94.2124	97.9070	101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)											Total = Sum(45)m =	1453.2630 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	192.5161	169.5733	177.8279	159.0482	155.5994	138.6564	132.8057	146.2239	146.1208	164.9416	174.8649	187.7619 (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	192.5161	169.5733	177.8279	159.0482	155.5994	138.6564	132.8057	146.2239	146.1208	164.9416	174.8649	187.7619 (64)
Heat gains from water heating, kWh/month	83.5736	74.0520	78.6897	71.8145	71.2988	65.0342	63.7199	68.1814	67.5161	74.4051	77.0735	81.9928 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	(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)	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	(71)
Water heating gains (Table 5)	112.3301	110.1965	105.7658	99.7423	95.8317	90.3253	85.6450	91.6417	93.7724	100.0068	107.0465	110.2054	(72)
Total internal gains	411.0628	408.8350	395.2113	373.3590	351.2252	329.9841	316.2737	322.3646	333.6883	355.7516	381.0145	399.9080	(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					3.3800	10.6334	0.4500		0.0000			0.7700			12.4535 (74)
South					7.1900	46.7521	0.4500		0.0000			0.7700			116.4751 (78)
Solar gains	128.9286	214.5554	283.4303	339.5892	373.6871	369.0881	356.5528	330.7150	302.4542	234.0783	153.4257	111.0270 (83)			
Total gains	539.9914	623.3905	678.6415	712.9482	724.9123	699.0721	672.8265	653.0795	636.1425	589.8299	534.4402	510.9350 (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	60.5995	60.7586	60.9154	61.6629	61.8048	62.4740	62.4740	62.5995	62.2145	61.8048	61.5184	61.2218
alpha	5.0400	5.0506	5.0610	5.1109	5.1203	5.1649	5.1649	5.1733	5.1476	5.1203	5.1012	5.0815
util living area	0.9965	0.9921	0.9824	0.9559	0.8870	0.7367	0.5616	0.5986	0.8197	0.9616	0.9923	0.9973 (86)
Tweekday	18.4258	18.6659	19.0041	19.4228	19.7619	19.9515	19.9870	19.9865	19.9043	19.4953	18.8909	18.3907
Tweekend	20.2496	20.3556	20.5061	20.6932	20.8573	20.9622	20.9924	20.9895	20.9313	20.7235	20.4514	20.2311
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.8419	20.0032	20.2377	20.5210	20.7798	20.9420	20.9883	20.9838	20.8927	20.5733	20.1433	19.8132 (87)
Th 2	19.9635	19.9659	19.9683	19.9795	19.9816	19.9914	19.9914	19.9932	19.9876	19.9816	19.9773	19.9729 (88)
util rest of house	0.9953	0.9895	0.9763	0.9394	0.8438	0.6470	0.4404	0.4780	0.7440	0.9439	0.9893	0.9964 (89)
Tweekday	18.4258	18.6659	19.0041	19.4228	19.7619	19.9515	19.9870	19.9865	19.9043	19.4953	18.8909	18.3907
Tweekend	18.4258	18.6659	19.0041	19.4228	19.7619	19.9515	19.9870	19.9865	19.9043	19.4953	18.8909	18.3907
MIT 2	18.4258	18.6659	19.0041	19.4228	19.7619	19.9515	19.9870	19.9865	19.9043	19.4953	18.8909	18.3907 (90)
Living area fraction	fLA = Living area / (4) =											0.2354 (91)
MIT	18.7591	18.9807	19.2945	19.6813	20.0015	20.1846	20.2226	20.2212	20.1369	19.7490	19.1857	18.7255 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7591	18.9807	19.2945	19.6813	20.0015	20.1846	20.2226	20.2212	20.1369	19.7490	19.1857	18.7255 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9933	0.9861	0.9710	0.9335	0.8448	0.6656	0.4691	0.5064	0.7566	0.9388	0.9859	0.9948	(94)
Useful gains	536.3721	614.7158	658.9696	665.5137	612.4243	465.2883	315.6430	330.7353	481.2918	553.7191	526.9233	508.2877	(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	1313.6314	1275.8987	1156.3675	962.6049	739.4943	492.1495	319.2474	336.0699	534.2278	814.9929	1081.6036	1306.2500	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	578.2809	444.3149	370.0640	213.9057	94.5401	0.0000	0.0000	0.0000	0.0000	194.3878	399.3698	593.6840	(98)
Space heating												2888.5472	(98)
Space heating per m2												(98) / (4) =	36.4348 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													277.2629 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1041.8080 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	578.2809	444.3149	370.0640	213.9057	94.5401	0.0000	0.0000	0.0000	0.0000	194.3878	399.3698	593.6840	(98)
Space heating efficiency (main heating system 1)	277.2629	277.2629	277.2629	277.2629	277.2629	0.0000	0.0000	0.0000	0.0000	277.2629	277.2629	277.2629	(210)
Space heating fuel (main heating system)	208.5677	160.2504	133.4704	77.1490	34.0976	0.0000	0.0000	0.0000	0.0000	70.1095	144.0401	214.1231	(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	192.5161	169.5733	177.8279	159.0482	155.5994	138.6564	132.8057	146.2239	146.1208	164.9416	174.8649	187.7619	(64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
Fuel for water heating, kWh/month	68.7643	60.5695	63.5179	56.8100	55.5782	49.5263	47.4365	52.2294	52.1925	58.9151	62.4595	67.0662	(219)
Water heating fuel used													695.0655 (219)
Annual totals kWh/year													
Space heating fuel - main system													1041.8080 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year													0.0000 (231)
Electricity for lighting (calculated in Appendix L)													372.0620 (232)
Total delivered energy for all uses													2108.9354 (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	1041.8080	0.5190	540.6983 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	695.0655	0.5190	360.7390 (264)
Space and water heating			901.4373 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/year			1094.5375 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8100 (273)

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

DER			13.8100 ZC1
Total Floor Area	TFA		79.2800
Assumed number of occupants	N		2.4491
CO2 emission factor in Table 12 for electricity displaced from grid	EF		0.5190
CO2 emissions from appliances, equation (L14)			16.2891 ZC2
CO2 emissions from cooking, equation (L16)			2.2424 ZC3
Total CO2 emissions			32.3415 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			32.3415 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	39.6400 (1b)	x 2.4000 (2b)	= 95.1360 (1b) - (3b)
First floor	39.6400 (1c)	x 2.4000 (2c)	= 95.1360 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 190.2720 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1577 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4077 (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) =					0.3465 (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	0.4418	0.4331	0.4245	0.3812	0.3725	0.3292	0.3292	0.3205	0.3465	0.3725	0.3898	0.4072	(22b)				
Effective ac	0.5976	0.5938	0.5901	0.5726	0.5694	0.5542	0.5542	0.5514	0.5600	0.5694	0.5760	0.5829	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			10.5700	1.3258	14.0133		(27)					
Heat Loss Floor 1			39.6400	0.1300	5.1532		(28a)					
External Wall 1	126.1000	12.6300	113.4700	0.1800	20.4246		(29a)					
External Roof 1	39.6400		39.6400	0.1300	5.1532		(30)					
Total net area of external elements Aum(A, m2)			205.3800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		46.8043		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0364 (36)					
Total fabric heat loss						(33) + (36) =	55.8407 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.5231	Feb 37.2851	Mar 37.0519	Apr 35.9563	May 35.7513	Jun 34.7971	Jul 34.7971	Aug 34.6204	Sep 35.1646	Oct 35.7513	Nov 36.1660	Dec 36.5995 (38)
Heat transfer coeff	93.3637	93.1258	92.8925	91.7969	91.5920	90.6377	90.6377	90.4610	91.0053	91.5920	92.0066	92.4401 (39)
Average = Sum(39)m / 12 =												91.7959 (39)
HLP	Jan 1.1776	Feb 1.1746	Mar 1.1717	Apr 1.1579	May 1.1553	Jun 1.1433	Jul 1.1433	Aug 1.1410	Sep 1.1479	Oct 1.1553	Nov 1.1605	Dec 1.1660 (40)
HLP (average)												1.1579 (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												2.4491 (42)
Average daily hot water use (litres/day)												92.3651 (43)
Daily hot water use	Jan 101.6016	Feb 97.9070	Mar 94.2124	Apr 90.5178	May 86.8232	Jun 83.1286	Jul 83.1286	Aug 86.8232	Sep 90.5178	Oct 94.2124	Nov 97.9070	Dec 101.6016 (44)
Energy conte	150.6723	131.7789	135.9841	118.5542	113.7556	98.1624	90.9619	104.3801	105.6268	123.0978	134.3709	145.9181 (45)
Energy content (annual)										Total = Sum(45)m =		1453.2630 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.6008	19.7668	20.3976	17.7831	17.0633	14.7244	13.6443	15.6570	15.8440	18.4647	20.1556	21.8877 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	199.9150	176.2562	185.2267	166.2084	162.9983	145.8166	140.2046	153.6228	153.2810	172.3405	182.0251	195.1607 (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	199.9150	176.2562	185.2267	166.2084	162.9983	145.8166	140.2046	153.6228	153.2810	172.3405	182.0251	195.1607 (64)
Heat gains from water heating, kWh/month	89.4927	79.3983	84.6088	77.5426	77.2179	70.7624	69.6390	74.1005	73.2443	80.3242	82.8017	87.9119 (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	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	122.4529	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0677	18.7121	15.2177	11.5208	8.6119	7.2706	7.8561	10.2116	13.7061	17.4030	20.3119	21.6532	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.9292	220.1906	214.4919	202.3600	187.0457	172.6524	163.0367	160.7753	166.4740	178.6059	193.9202	208.3136	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	35.2453	(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)	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	-97.9623	(71)
Water heating gains (Table 5)	120.2859	118.1522	113.7216	107.6981	103.7875	98.2811	93.6008	99.5975	101.7281	107.9626	115.0023	118.1611	(72)
Total internal gains	422.0186	419.7908	406.1670	384.3148	362.1809	340.9398	327.2295	333.3203	344.6441	366.7073	391.9703	410.8638	(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					3.3800	10.6334	0.6300	0.7000			0.7700	10.9840	(74)
South					7.1900	46.7521	0.6300	0.7000			0.7700	102.7310	(78)
Solar gains	113.7150	189.2379	249.9855	299.5177	329.5921	325.5357	314.4796	291.6906	266.7646	206.4571	135.3214	97.9258	(83)
Total gains	535.7336	609.0287	656.1525	683.8324	691.7730	666.4755	641.7091	625.0109	611.4087	573.1644	527.2917	508.7896	(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	58.9689	59.1196	59.2680	59.9754	60.1096	60.7424	60.7424	60.8611	60.4971	60.1096	59.8387	59.5581
alpha	4.9313	4.9413	4.9512	4.9984	5.0073	5.0495	5.0495	5.0574	5.0331	5.0073	4.9892	4.9705
util living area	0.9966	0.9930	0.9852	0.9640	0.9071	0.7719	0.5989	0.6347	0.8452	0.9671	0.9929	0.9974 (86)
MIT	19.7916	19.9451	20.1735	20.4659	20.7346	20.9221	20.9828	20.9769	20.8682	20.5287	20.1069	19.7650 (87)
Th 2	19.9379	19.9403	19.9427	19.9538	19.9559	19.9657	19.9657	19.9675	19.9619	19.9559	19.9517	19.9473 (88)
util rest of house	0.9955	0.9907	0.9799	0.9500	0.8683	0.6825	0.4695	0.5073	0.7727	0.9515	0.9901	0.9965 (89)
MIT 2	18.3381	18.5632	18.8959	19.3213	19.6864	19.9110	19.9591	19.9577	19.8559	19.4158	18.8081	18.3061 (90)
Living area fraction	18.6802	18.8885	19.1966	19.5907	19.9331	20.1490	20.2000	20.1976	20.0942	19.6778	19.1138	18.6495 (92)
Temperature adjustment	18.6802	18.8885	19.1966	19.5907	19.9331	20.1490	20.2000	20.1976	20.0942	19.6778	19.1138	18.6495 (93)
adjusted MIT	18.6802	18.8885	19.1966	19.5907	19.9331	20.1490	20.2000	20.1976	20.0942	19.6778	19.1138	18.6495 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9935	0.9874	0.9749	0.9437	0.8673	0.7000	0.5001	0.5373	0.7833	0.9460	0.9868	0.9949	(94)
Useful gains	532.2492	601.3713	639.6850	645.3442	599.9839	466.5335	320.9372	335.8303	478.9309	542.2091	520.3427	506.1827	(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	1342.5898	1302.6863	1179.4174	981.3726	754.0862	502.9497	326.2992	343.5348	545.5045	831.4517	1105.3494	1335.7121	(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	602.8934	471.2837	401.5609	241.9404	114.6521	0.0000	0.0000	0.0000	0.0000	215.1965	421.2048	617.1699	(98)
Space heating												3085.9018	(98)
Space heating per m2												(98) / (4) =	38.9241 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3300.4297 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.8934	471.2837	401.5609	241.9404	114.6521	0.0000	0.0000	0.0000	0.0000	215.1965	421.2048	617.1699	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	644.8058	504.0467	429.4769	258.7598	122.6226	0.0000	0.0000	0.0000	0.0000	230.1567	450.4864	660.0748	(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	199.9150	176.2562	185.2267	166.2084	162.9983	145.8166	140.2046	153.6228	153.2810	172.3405	182.0251	195.1607	(64)
Efficiency of water heater (217)m	87.5759	87.3133	86.8251	85.8143	83.8960	79.8000	79.8000	79.8000	79.8000	85.4073	86.9807	87.6756	(216)
Fuel for water heating, kWh/month	228.2763	201.8663	213.3332	193.6838	194.2861	182.7276	175.6950	192.5098	192.0814	201.7866	209.2706	222.5940	(219)
Water heating fuel used												2408.1107	(219)
Annual totals kWh/year													
Space heating fuel - main system												3300.4297	(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)												372.0620	(232)
Total delivered energy for all uses												6155.6025	(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	3300.4297	0.2160	712.8928 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2408.1107	0.2160	520.1519 (264)
Space and water heating			1233.0447 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.0620	0.5190	193.1002 (268)
Total CO2, kg/m2/year			1465.0699 (272)
Emissions per m2 for space and water heating			15.5530 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.4357 (272b)
Emissions per m2 for pumps and fans			0.4910 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5530 * 1.55) + 2.4357 + 0.4910, rounded to 2 d.p.			27.0300 (273)

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Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 02 AFF				Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (AFF/02)	Prop Type Ref	TYPE AFF / 3 BED / 2 STOREY			
Property	TYPE AFF / 3 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	85 B	DER	16.38	TER	17.80	
Environmental	87 B	% DER<TER	7.99			
CO ₂ Emissions (t/year)	1.26	DFEE	41.81	TFEE	51.41	
General Requirements Compliance	Pass	% DFEE<TFEE	18.66			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.38 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.8 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.54 m², No overhang
Windows facing South: 7.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1339 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3839 (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) =							0.3263 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834	(22b)				
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735	(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					
WINDOW (Uw = 1.30)			11.4800	1.2357	14.1863		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			46.6800	0.1100	5.1348		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.2000	24.7480		(29a)					
External Roof 1	46.6800		46.6800	0.1000	4.6680		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7971		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							8.0724 (36)					
Total fabric heat loss						(33) + (36) =	58.8695 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3698	Feb 43.1213	Mar 42.8777	Apr 41.7337	May 41.5197	Jun 40.5232	Jul 40.5232	Aug 40.3387	Sep 40.9070	Oct 41.5197	Nov 41.9527	Dec 42.4054 (38)
Heat transfer coeff	102.2393	101.9908	101.7473	100.6032	100.3892	99.3927	99.3927	99.2082	99.7766	100.3892	100.8222	101.2749 (39)
Average = Sum(39)m / 12 =												100.6022 (39)
HLP	Jan 1.0951	Feb 1.0924	Mar 1.0898	Apr 1.0776	May 1.0753	Jun 1.0646	Jul 1.0646	Aug 1.0626	Sep 1.0687	Oct 1.0753	Nov 1.0799	Dec 1.0848 (40)
HLP (average)												1.0776 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3470	103.4434	99.5399	95.6364	91.7329	87.8293	87.8293	91.7329	95.6364	99.5399	103.4434	107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)												Total = Sum(45)m = 1535.4418 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.6945	13.2588	14.6459	14.1177	14.5477	14.0316	14.4701	14.5204	14.0785	14.6053	14.1842	14.6794 (61)
Solar input	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488 (64)
	56.6051	49.6089	51.4330	45.1778	43.5995	37.9926	35.5726	40.2991	40.6265	46.8958	50.7508	54.9312 (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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	76.0821	73.8228	69.1303	62.7469	58.6015	52.7674	47.8127	54.1654	56.4257	63.0320	70.4873	73.8322	(72)
Total internal gains	411.3674	408.9542	393.8503	369.5875	344.8856	321.3261	306.2263	312.7327	325.4045	349.8902	377.9019	398.9724	(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					3.5400	10.6334	0.4500	0.0000			0.7700			13.0430	(74)
South					7.9400	46.7521	0.4500	0.0000			0.7700			128.6247	(78)
Solar gains	141.6678	235.5801	310.6913	371.3113	407.6815	402.2510	388.7625	361.2590	331.2334	256.8813	168.5544	122.0169	(83)		
Total gains	553.0351	644.5343	704.5416	740.8988	752.5671	723.5771	694.9887	673.9918	656.6379	606.7715	546.4563	520.9893	(84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4133	63.5678	63.7200	64.4446	64.5820	65.2294	65.2294	65.3508	64.9785	64.5820	64.3046	64.0172	
alpha	5.2276	5.2379	5.2480	5.2963	5.3055	5.3486	5.3486	5.3567	5.3319	5.3055	5.2870	5.2678	
util living area	0.9981	0.9955	0.9891	0.9705	0.9169	0.7836	0.6086	0.6475	0.8613	0.9757	0.9958	0.9986	(86)
MIT	19.8260	19.9829	20.2082	20.4921	20.7515	20.9294	20.9853	20.9796	20.8745	20.5390	20.1265	19.7975	(87)
Th 2	20.0048	20.0070	20.0091	20.0192	20.0211	20.0298	20.0298	20.0315	20.0265	20.0211	20.0173	20.0133	(88)
util rest of house	0.9975	0.9939	0.9852	0.9588	0.8818	0.6991	0.4849	0.5257	0.7949	0.9638	0.9941	0.9982	(89)
MIT 2	18.9338	19.0919	19.3171	19.6030	19.8460	19.9953	20.0259	20.0254	19.9556	19.6529	19.2437	18.9123	(90)
Living area fraction	19.1473	19.3051	19.5303	19.8158	20.0627	20.2188	20.2554	20.2537	20.1755	19.8650	19.4550	19.1241	(91)
MIT	18.9973	19.1551	19.3803	19.6658	19.9127	20.0688	20.1054	20.1037	20.0255	19.7150	19.3050	18.9741	(92)
Temperature adjustment												-0.1500	
adjusted MIT													(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	551.1515	639.4396	691.7345	706.4079	660.1207	508.5898	344.0364	360.8166	521.8885	581.7801	542.2746	519.6773	(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	1502.6447	1453.8901	1310.5363	1083.0710	824.4618	543.5570	348.4159	367.4385	591.2252	915.0424	1230.5320	1496.2493	(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	707.9109	547.3108	460.3886	271.1974	122.2698	0.0000	0.0000	0.0000	0.0000	247.9471	495.5454	726.5696	(98)
Space heating												3579.1396	(98)
Space heating per m2												38.3370	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3954.8503 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	707.9109	547.3108	460.3886	271.1974	122.2698	0.0000	0.0000	0.0000	0.0000	247.9471	495.5454	726.5696	(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)	782.2220	604.7633	508.7166	299.6656	135.1048	0.0000	0.0000	0.0000	0.0000	273.9747	547.5639	802.8393	(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	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488	(64)
Efficiency of water heater	89.8505	89.7829	89.6590	89.3877	88.7937	87.3000	87.3000	87.3000	87.3000	89.2940	89.7121	89.8788	(217)
Fuel for water heating, kWh/month	193.5291	169.8425	176.5796	155.9228	151.7404	134.8738	126.6618	142.9587	143.9613	162.0087	174.0607	187.8629	(219)
Water heating fuel used												1920.0024	(219)
Annual totals kWh/year													
Space heating fuel - main system												3954.8503	(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)												426.0605	(232)
Total delivered energy for all uses												6375.9132	(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	3954.8503	0.2160	854.2477 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.0024	0.2160	414.7205 (264)
Space and water heating			1268.9682 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	426.0605	0.5190	221.1254 (268)
Total CO2, kg/year			1529.0186 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.3800 (273)

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

DER		16.3800	ZC1
Total Floor Area	TFA	93.3600	
Assumed number of occupants	N	2.6690	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5587	ZC2
CO2 emissions from cooking, equation (L16)		1.9607	ZC3
Total CO2 emissions		33.8995	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		33.8995	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	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1339 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3839 (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) =	0.3263 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	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)		
Adj infilt rate	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)		
	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834 (22b)		
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			11.4800	1.3258	15.2197		(27)					
Heat Loss Floor 1			46.6800	0.1300	6.0684		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.1800	22.2732		(29a)					
External Roof 1	46.6800		46.6800	0.1300	6.0684		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.6897		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8574 (36)					
Total fabric heat loss						(33) + (36) =	61.5471 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3698	Feb 43.1213	Mar 42.8777	Apr 41.7337	May 41.5197	Jun 40.5232	Jul 40.5232	Aug 40.3387	Sep 40.9070	Oct 41.5197	Nov 41.9527	Dec 42.4054 (38)
Heat transfer coeff	104.9169	104.6684	104.4248	103.2808	103.0668	102.0703	102.0703	101.8858	102.4541	103.0668	103.4998	103.9525 (39)
Average = Sum(39)m / 12 =												103.2798 (39)
HLP	Jan 1.1238	Feb 1.1211	Mar 1.1185	Apr 1.1063	May 1.1040	Jun 1.0933	Jul 1.0933	Aug 1.0913	Sep 1.0974	Oct 1.1040	Nov 1.1086	Dec 1.1135 (40)
HLP (average)												1.1063 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
Daily hot water use	Jan 107.3470	Feb 103.4434	Mar 99.5399	Apr 95.6364	May 91.7329	Jun 87.8293	Jul 87.8293	Aug 91.7329	Sep 95.6364	Oct 99.5399	Nov 103.4434	Dec 107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)												Total = Sum(45)m = 1535.4418 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (46)
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 TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.7245	47.1632	46.7461	43.3131	44.7569	46.7461	47.1632	50.7245	49.3151	50.9589 (61)
Solar input	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283 (64)
	65.6712	57.8011	60.4526	53.4391	51.6491	45.3129	43.1443	48.3555	48.8977	55.9256	59.5335	64.0011 (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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	88.2678	86.0135	81.2535	74.2210	69.4208	62.9346	57.9897	64.9939	67.9135	75.1689	82.6855	86.0229	(72)
Total internal gains	423.5530	421.1449	405.9735	381.0617	355.7050	331.4933	316.4032	323.5613	336.8922	362.0270	390.1001	411.1631	(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					3.5400	10.6334	0.6300	0.7000	0.7700	11.5039 (74)		
South					7.9400	46.7521	0.6300	0.7000	0.7700	113.4470 (78)		
Solar gains	124.9510	207.7816	274.0297	327.4966	359.5751	354.7854	342.8885	318.6305	292.1478	226.5693	148.6650	107.6189 (83)
Total gains	548.5040	628.9266	680.0032	708.5582	715.2801	686.2787	659.2918	642.1917	629.0401	588.5963	538.7651	518.7820 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7949	61.9416	62.0861	62.7738	62.9042	63.5183	63.5183	63.6333	63.2803	62.9042	62.6410	62.3683	
alpha	5.1197	5.1294	5.1391	5.1849	5.1936	5.2346	5.2346	5.2422	5.2187	5.1936	5.1761	5.1579	
util living area	0.9982	0.9960	0.9909	0.9765	0.9337	0.8182	0.6492	0.6858	0.8839	0.9795	0.9961	0.9987	(86)
MIT	19.7824	19.9293	20.1498	20.4343	20.7051	20.9068	20.9785	20.9713	20.8467	20.4974	20.0858	19.7561	(87)
Th 2	19.9815	19.9836	19.9857	19.9957	19.9976	20.0063	20.0063	20.0079	20.0029	19.9976	19.9938	19.9899	(88)
util rest of house	0.9976	0.9946	0.9876	0.9667	0.9034	0.7364	0.5184	0.5589	0.8222	0.9691	0.9945	0.9982	(89)
MIT 2	18.3558	18.5717	18.8941	19.3111	19.6870	19.9371	19.9976	19.9950	19.8727	19.4059	18.8081	18.3234	(90)
Living area fraction	18.6972	18.8966	19.1946	19.5799	19.9306	20.1692	20.2323	20.2286	20.1058	19.6671	19.1138	18.6662	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6972	18.8966	19.1946	19.5799	19.9306	20.1692	20.2323	20.2286	20.1058	19.6671	19.1138	18.6662	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9964	0.9925	0.9840	0.9615	0.9009	0.7515	0.5499	0.5891	0.8298	0.9644	0.9925	0.9973	(94)
Ext temp.	546.5462	624.2089	669.1021	681.2510	644.3725	515.7567	362.5507	378.3334	521.9757	567.6548	534.7176	517.3764	(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	1510.5095	1464.9999	1325.6268	1103.0242	848.3016	568.4463	370.7496	390.0783	615.3163	934.5196	1243.4291	1503.7973	(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	717.1887	565.0116	488.4544	303.6767	151.7232	0.0000	0.0000	0.0000	0.0000	272.9475	510.2723	733.8971	(98)
Space heating per m2												3743.1714	(98)
												40.0940	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4007.6781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	717.1887	565.0116	488.4544	303.6767	151.7232	0.0000	0.0000	0.0000	0.0000	272.9475	510.2723	733.8971	(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)	767.8679	604.9374	522.9704	325.1357	162.4445	0.0000	0.0000	0.0000	0.0000	292.2350	546.3301	785.7571	(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	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283	(64)
Efficiency of water heater	87.8947	87.6770	87.2749	86.4616	84.8117	80.3000	80.3000	80.3000	80.3000	86.0858	87.4026	87.9826	(217)
Fuel for water heating, kWh/month	239.0945	211.2962	222.7422	199.4196	196.8294	183.0964	175.4203	195.5525	197.7122	210.0034	218.8543	233.1465	(219)
Water heating fuel used												2483.1674	(219)
Annual totals kWh/year													
Space heating fuel - main system												4007.6781	(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)												426.0605	(232)
Total delivered energy for all uses												6991.9060	(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	4007.6781	0.2160	865.6585 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2483.1674	0.2160	536.3642 (264)
Space and water heating			1402.0226 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	426.0605	0.5190	221.1254 (268)
Total CO2, kg/m2/year			1662.0730 (272)
Emissions per m2 for space and water heating			15.0174 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3685 (272b)
Emissions per m2 for pumps and fans			0.4169 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0174 * 1.00) + 2.3685 + 0.4169, rounded to 2 d.p.			17.8000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 02 AFF				Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (AFF/02)	Prop Type Ref	TYPE AFF / 3 BED / 2 STOREY			
Property	TYPE AFF / 3 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	85 B	DER	15.80	TER	17.80	
Environmental	87 B	% DER<TER	11.25			
CO ₂ Emissions (t/year)	1.23	DFEE	41.81	TFEE	51.41	
General Requirements Compliance	Pass	% DFEE<TFEE	18.66			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.80 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.8 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.54 m², No overhang
Windows facing South: 7.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1339 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3839 (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) =	0.3263 (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	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834 (22b)
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735 (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					
WINDOW (Uw = 1.30)			11.4800	1.2357	14.1863		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			46.6800	0.1100	5.1348		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.2000	24.7480		(29a)					
External Roof 1	46.6800		46.6800	0.1000	4.6680		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	50.7971		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							8.0724 (36)					
Total fabric heat loss						(33) + (36) =	58.8695 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	43.3698	43.1213	42.8777	41.7337	41.5197	40.5232	40.5232	40.3387	40.9070	41.5197	41.9527	42.4054 (38)
Heat transfer coeff	102.2393	101.9908	101.7473	100.6032	100.3892	99.3927	99.3927	99.2082	99.7766	100.3892	100.8222	101.2749 (39)
Average = Sum(39)m / 12 =												100.6022 (39)
HLP	Jan 1.0951	Feb 1.0924	Mar 1.0898	Apr 1.0776	May 1.0753	Jun 1.0646	Jul 1.0646	Aug 1.0626	Sep 1.0687	Oct 1.0753	Nov 1.0799	Dec 1.0848 (40)
HLP (average)												1.0776 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
Daily hot water use	107.3470	103.4434	99.5399	95.6364	91.7329	87.8293	87.8293	91.7329	95.6364	99.5399	103.4434	107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)										Total = Sum(45)m =		1535.4418 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.6945	13.2588	14.6459	14.1177	14.5477	14.0316	14.4701	14.5204	14.0785	14.6053	14.1842	14.6794 (61)
Solar input	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488 (64)
	56.6051	49.6089	51.4330	45.1778	43.5995	37.9926	35.5726	40.2991	40.6265	46.8958	50.7508	54.9312 (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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	76.0821	73.8228	69.1303	62.7469	58.6015	52.7674	47.8127	54.1654	56.4257	63.0320	70.4873	73.8322	(72)
Total internal gains	411.3674	408.9542	393.8503	369.5875	344.8856	321.3261	306.2263	312.7327	325.4045	349.8902	377.9019	398.9724	(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					3.5400	10.6334	0.4500	0.0000			0.7700			13.0430 (74)
South					7.9400	46.7521	0.4500	0.0000			0.7700			128.6247 (78)
Solar gains	141.6678	235.5801	310.6913	371.3113	407.6815	402.2510	388.7625	361.2590	331.2334	256.8813	168.5544	122.0169	(83)	
Total gains	553.0351	644.5343	704.5416	740.8988	752.5671	723.5771	694.9887	673.9918	656.6379	606.7715	546.4563	520.9893	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4133	63.5678	63.7200	64.4446	64.5820	65.2294	65.2294	65.3508	64.9785	64.5820	64.3046	64.0172	
alpha	5.2276	5.2379	5.2480	5.2963	5.3055	5.3486	5.3486	5.3567	5.3319	5.3055	5.2870	5.2678	
util living area	0.9981	0.9955	0.9891	0.9705	0.9169	0.7836	0.6086	0.6475	0.8613	0.9757	0.9958	0.9986	(86)
MIT	19.8260	19.9829	20.2082	20.4921	20.7515	20.9294	20.9853	20.9796	20.8745	20.5390	20.1265	19.7975	(87)
Th 2	20.0048	20.0070	20.0091	20.0192	20.0211	20.0298	20.0298	20.0315	20.0265	20.0211	20.0173	20.0133	(88)
util rest of house	0.9975	0.9939	0.9852	0.9588	0.8818	0.6991	0.4849	0.5257	0.7949	0.9638	0.9941	0.9982	(89)
MIT 2	18.4362	18.6667	18.9955	19.4097	19.7646	19.9792	20.0240	20.0225	19.9227	19.4819	18.8843	18.4008	(90)
Living area fraction	18.7688	18.9816	19.2857	19.6687	20.0008	20.2066	20.2540	20.2516	20.1505	19.7348	19.1816	18.7350	(91)
MIT	18.7688	18.9816	19.2857	19.6687	20.0008	20.2066	20.2540	20.2516	20.1505	19.7348	19.1816	18.7350	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6188	18.8316	19.1357	19.5187	19.8508	20.0566	20.1040	20.1016	20.0005	19.5848	19.0316	18.5850	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	550.9087	638.8895	690.6601	704.5825	658.0461	507.7303	343.9063	360.6232	520.5582	580.3648	541.8244	519.5006	(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	1463.9419	1420.9003	1285.6470	1068.2730	818.2486	542.3421	348.2762	367.2247	588.7267	901.9794	1202.9665	1456.8382	(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	679.2967	525.5112	442.6702	261.8571	119.1907	0.0000	0.0000	0.0000	0.0000	239.2813	476.0224	697.3791	(98)
Space heating												3441.2087	(98)
Space heating per m2												36.8596	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													92.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3704.2074 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	679.2967	525.5112	442.6702	261.8571	119.1907	0.0000	0.0000	0.0000	0.0000	239.2813	476.0224	697.3791	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	731.2128	565.6741	476.5018	281.8699	128.3000	0.0000	0.0000	0.0000	0.0000	257.5686	512.4030	750.6772	(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	173.8870	152.4895	158.3196	139.3759	134.7359	117.7449	110.5757	124.8030	125.6782	144.6640	156.1534	168.8488	(64)
Efficiency of water heater	89.8289	89.7600	89.6345	89.3622	88.7734	87.3000	87.3000	87.3000	87.3000	89.2671	89.6879	89.8580	(217)
Fuel for water heating, kWh/month	193.5757	169.8858	176.6280	155.9674	151.7751	134.8738	126.6618	142.9587	143.9613	162.0574	174.1075	187.9063	(219)
Water heating fuel used												1920.3589	(219)
Annual totals kWh/year													
Space heating fuel - main system												3704.2074	(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)												426.0605	(232)
Total delivered energy for all uses												6125.6268	(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	3704.2074	0.2160	800.1088 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.3589	0.2160	414.7975 (264)
Space and water heating			1214.9063 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	426.0605	0.5190	221.1254 (268)
Total CO2, kg/year			1474.9567 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8000 (273)

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

DER		15.8000	ZC1
Total Floor Area	TFA	93.3600	
Assumed number of occupants	N	2.6690	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5587	ZC2
CO2 emissions from cooking, equation (L16)		1.9607	ZC3
Total CO2 emissions		33.3195	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		33.3195	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	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1339 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3839 (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) =					0.3263 (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	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834	(22b)				
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			11.4800	1.3258	15.2197		(27)					
Heat Loss Floor 1			46.6800	0.1300	6.0684		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.1800	22.2732		(29a)					
External Roof 1	46.6800		46.6800	0.1300	6.0684		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.6897		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8574 (36)					
Total fabric heat loss						(33) + (36) =	61.5471 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3698	Feb 43.1213	Mar 42.8777	Apr 41.7337	May 41.5197	Jun 40.5232	Jul 40.5232	Aug 40.3387	Sep 40.9070	Oct 41.5197	Nov 41.9527	Dec 42.4054 (38)
Heat transfer coeff	104.9169	104.6684	104.4248	103.2808	103.0668	102.0703	102.0703	101.8858	102.4541	103.0668	103.4998	103.9525 (39)
Average = Sum(39)m / 12 =												103.2798 (39)
HLP	Jan 1.1238	Feb 1.1211	Mar 1.1185	Apr 1.1063	May 1.1040	Jun 1.0933	Jul 1.0933	Aug 1.0913	Sep 1.0974	Oct 1.1040	Nov 1.1086	Dec 1.1135 (40)
HLP (average)												1.1063 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
Daily hot water use	Jan 107.3470	Feb 103.4434	Mar 99.5399	Apr 95.6364	May 91.7329	Jun 87.8293	Jul 87.8293	Aug 91.7329	Sep 95.6364	Oct 99.5399	Nov 103.4434	Dec 107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)												Total = Sum(45)m = 1535.4418 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (46)
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												

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Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.7245	47.1632	46.7461	43.3131	44.7569	46.7461	47.1632	50.7245	49.3151	50.9589 (61)
Solar input	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283 (64)
	65.6712	57.8011	60.4526	53.4391	51.6491	45.3129	43.1443	48.3555	48.8977	55.9256	59.5335	64.0011 (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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	88.2678	86.0135	81.2535	74.2210	69.4208	62.9346	57.9897	64.9939	67.9135	75.1689	82.6855	86.0229	(72)
Total internal gains	423.5530	421.1449	405.9735	381.0617	355.7050	331.4933	316.4032	323.5613	336.8922	362.0270	390.1001	411.1631	(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					3.5400	10.6334	0.6300	0.7000	0.7700	11.5039 (74)		
South					7.9400	46.7521	0.6300	0.7000	0.7700	113.4470 (78)		
Solar gains	124.9510	207.7816	274.0297	327.4966	359.5751	354.7854	342.8885	318.6305	292.1478	226.5693	148.6650	107.6189 (83)
Total gains	548.5040	628.9266	680.0032	708.5582	715.2801	686.2787	659.2918	642.1917	629.0401	588.5963	538.7651	518.7820 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	61.7949	61.9416	62.0861	62.7738	62.9042	63.5183	63.5183	63.6333	63.2803	62.9042	62.6410	62.3683	
alpha	5.1197	5.1294	5.1391	5.1849	5.1936	5.2346	5.2346	5.2422	5.2187	5.1936	5.1761	5.1579	
util living area	0.9982	0.9960	0.9909	0.9765	0.9337	0.8182	0.6492	0.6858	0.8839	0.9795	0.9961	0.9987	(86)
MIT	19.7824	19.9293	20.1498	20.4343	20.7051	20.9068	20.9785	20.9713	20.8467	20.4974	20.0858	19.7561	(87)
Th 2	19.9815	19.9836	19.9857	19.9957	19.9976	20.0063	20.0063	20.0079	20.0029	19.9976	19.9938	19.9899	(88)
util rest of house	0.9976	0.9946	0.9876	0.9667	0.9034	0.7364	0.5184	0.5589	0.8222	0.9691	0.9945	0.9982	(89)
MIT 2	18.3558	18.5717	18.8941	19.3111	19.6870	19.9371	19.9976	19.9950	19.8727	19.4059	18.8081	18.3234	(90)
Living area fraction	18.6972	18.8966	19.1946	19.5799	19.9306	20.1692	20.2323	20.2286	20.1058	19.6671	19.1138	18.6662	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6972	18.8966	19.1946	19.5799	19.9306	20.1692	20.2323	20.2286	20.1058	19.6671	19.1138	18.6662	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9964	0.9925	0.9840	0.9615	0.9009	0.7515	0.5499	0.5891	0.8298	0.9644	0.9925	0.9973	(94)
Ext temp.	546.5462	624.2089	669.1021	681.2510	644.3725	515.7567	362.5507	378.3334	521.9757	567.6548	534.7176	517.3764	(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	1510.5095	1464.9999	1325.6268	1103.0242	848.3016	568.4463	370.7496	390.0783	615.3163	934.5196	1243.4291	1503.7973	(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	717.1887	565.0116	488.4544	303.6767	151.7232	0.0000	0.0000	0.0000	0.0000	272.9475	510.2723	733.8971	(98)
Space heating per m2												3743.1714	(98)
												40.0940	(99)

8c. Space cooling requirement

Not applicable

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

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Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4007.6781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	717.1887	565.0116	488.4544	303.6767	151.7232	0.0000	0.0000	0.0000	0.0000	272.9475	510.2723	733.8971	(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)	767.8679	604.9374	522.9704	325.1357	162.4445	0.0000	0.0000	0.0000	0.0000	292.2350	546.3301	785.7571	(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	210.1514	185.2581	194.3981	172.4213	166.9343	147.0264	140.8625	157.0286	158.7629	180.7832	191.2843	205.1283	(64)
Efficiency of water heater	87.8947	87.6770	87.2749	86.4616	84.8117	80.3000	80.3000	80.3000	80.3000	86.0858	87.4026	87.9826	(217)
Fuel for water heating, kWh/month	239.0945	211.2962	222.7422	199.4196	196.8294	183.0964	175.4203	195.5525	197.7122	210.0034	218.8543	233.1465	(219)
Water heating fuel used												2483.1674	(219)
Annual totals kWh/year													
Space heating fuel - main system												4007.6781	(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)												426.0605	(232)
Total delivered energy for all uses												6991.9060	(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	4007.6781	0.2160	865.6585 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2483.1674	0.2160	536.3642 (264)
Space and water heating			1402.0226 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	426.0605	0.5190	221.1254 (268)
Total CO2, kg/m2/year			1662.0730 (272)
Emissions per m2 for space and water heating			15.0174 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3685 (272b)
Emissions per m2 for pumps and fans			0.4169 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0174 * 1.00) + 2.3685 + 0.4169, rounded to 2 d.p.			17.8000 (273)

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Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE 02 AFF				Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (AFF/02)	Prop Type Ref	TYPE AFF / 3 BED / 2 STOREY			
Property	TYPE AFF / 3 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	89 B	DER	12.39	TER	25.50	
Environmental	90 B	% DER<TER	51.42			
CO ₂ Emissions (t/year)	0.98	DFEE	41.81	TFEE	51.41	
General Requirements Compliance	Pass	% DFEE<TFEE	18.66			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 25.50 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.39 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.4 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)41.8 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.25 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.11 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	3.54 m ² , No overhang
Windows facing South:	7.94 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K

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	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1339 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3839 (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) =							0.3263 (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	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834	(22b)				
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735	(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					
WINDOW (Uw = 1.30)			11.4800	1.2357	14.1863		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			46.6800	0.1100	5.1348		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.2000	24.7480		(29a)					
External Roof 1	46.6800		46.6800	0.1000	4.6680		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.7971		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							8.0724 (36)					
Total fabric heat loss						(33) + (36) =	58.8695 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3698	Feb 43.1213	Mar 42.8777	Apr 41.7337	May 41.5197	Jun 40.5232	Jul 40.5232	Aug 40.3387	Sep 40.9070	Oct 41.5197	Nov 41.9527	Dec 42.4054 (38)
Heat transfer coeff	102.2393	101.9908	101.7473	100.6032	100.3892	99.3927	99.3927	99.2082	99.7766	100.3892	100.8222	101.2749 (39)
Average = Sum(39)m / 12 =												100.6022 (39)
HLP	Jan 1.0951	Feb 1.0924	Mar 1.0898	Apr 1.0776	May 1.0753	Jun 1.0646	Jul 1.0646	Aug 1.0626	Sep 1.0687	Oct 1.0753	Nov 1.0799	Dec 1.0848 (40)
HLP (average)												1.0776 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
Daily hot water use	Jan 107.3470	Feb 103.4434	Mar 99.5399	Apr 95.6364	May 91.7329	Jun 87.8293	Jul 87.8293	Aug 91.7329	Sep 95.6364	Oct 99.5399	Nov 103.4434	Dec 107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)												Total = Sum(45)m = 1535.4418 (45)
Distribution loss (46)m = 0.15 x (45)m												
	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	201.0363	177.0251	185.5175	165.7522	162.0320	144.2073	137.9494	152.1264	152.0937	171.9025	182.4632	196.0132	(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	201.0363	177.0251	185.5175	165.7522	162.0320	144.2073	137.9494	152.1264	152.0937	171.9025	182.4632	196.0132	(64)
Heat gains from water heating, kWh/month	86.4065	76.5297	81.2465	74.0435	73.4376	66.8799	65.4302	70.1440	69.5021	76.7196	79.6000	84.7364	(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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	116.1378	113.8835	109.2023	102.8383	98.7065	92.8887	87.9438	94.2796	96.5307	103.1177	110.5555	113.8930	(72)
Total internal gains	448.4230	446.0150	430.9223	406.6789	381.9906	358.4473	343.3573	349.8469	362.5095	386.9758	414.9701	436.0331	(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				3.5400	10.6334	0.4500		0.0000	0.7700		13.0430 (74)	
South				7.9400	46.7521	0.4500		0.0000	0.7700		128.6247 (78)	
Solar gains	141.6678	235.5801	310.6913	371.3113	407.6815	402.2510	388.7625	361.2590	331.2334	256.8813	168.5544	122.0169 (83)
Total gains	590.0908	681.5951	741.6136	777.9902	789.6721	760.6984	732.1198	711.1059	693.7428	643.8571	583.5246	558.0501 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	63.4133	63.5678	63.7200	64.4446	64.5820	65.2294	65.2294	65.3508	64.9785	64.5820	64.3046	64.0172	
alpha	5.2276	5.2379	5.2480	5.2963	5.3055	5.3486	5.3486	5.3567	5.3319	5.3055	5.2870	5.2678	
util living area	0.9975	0.9941	0.9864	0.9642	0.9028	0.7587	0.5815	0.6190	0.8388	0.9690	0.9943	0.9981	(86)
Weekday	18.4905	18.7198	19.0459	19.4531	19.7925	19.9876	20.0252	20.0244	19.9389	19.5263	18.9375	18.4553	
Weekend	20.2651	20.3662	20.5109	20.6921	20.8545	20.9610	20.9923	20.9893	20.9297	20.7230	20.4590	20.2468	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8658	20.0195	20.2452	20.5193	20.7754	20.9402	20.9881	20.9835	20.8902	20.5725	20.1553	19.8376	(87)
Th 2	20.0048	20.0070	20.0091	20.0192	20.0211	20.0298	20.0298	20.0315	20.0265	20.0211	20.0173	20.0133	(88)
util rest of house	0.9966	0.9922	0.9815	0.9505	0.8641	0.6724	0.4614	0.5000	0.7680	0.9545	0.9920	0.9975	(89)
Weekday	18.4905	18.7198	19.0459	19.4531	19.7925	19.9876	20.0252	20.0244	19.9389	19.5263	18.9375	18.4553	
Weekend	18.4905	18.7198	19.0459	19.4531	19.7925	19.9876	20.0252	20.0244	19.9389	19.5263	18.9375	18.4553	
MIT 2	18.4905	18.7198	19.0459	19.4531	19.7925	19.9876	20.0252	20.0244	19.9389	19.5263	18.9375	18.4553	(90)
Living area fraction	fLA = Living area / (4) =												0.2393 (91)
MIT	18.8195	19.0308	19.3329	19.7082	20.0277	20.2156	20.2556	20.2539	20.1665	19.7766	19.2289	18.7861	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8195	19.0308	19.3329	19.7082	20.0277	20.2156	20.2556	20.2539	20.1665	19.7766	19.2289	18.7861	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9951	0.9895	0.9771	0.9450	0.8644	0.6904	0.4903	0.5285	0.7796	0.9497	0.9894	0.9963	(94)
Ext temp.	587.2212	674.4151	724.6595	735.2061	682.5807	525.1546	358.9768	375.8476	540.8135	611.4993	577.3619	555.9869	(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	1484.4687	1441.2096	1305.7107	1087.3384	836.0118	558.1466	363.3441	382.3390	605.2987	921.2361	1222.8659	1477.2039	(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	667.5522	515.2859	432.3020	253.5352	114.1527	0.0000	0.0000	0.0000	0.0000	230.4442	464.7629	685.3855	(98)
Space heating per m ²	(98) / (4) =												36.0264 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													312.0813 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1077.7386 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	667.5522	515.2859	432.3020	253.5352	114.1527	0.0000	0.0000	0.0000	0.0000	230.4442	464.7629	685.3855	(98)
Space heating efficiency (main heating system 1)	312.0813	312.0813	312.0813	312.0813	312.0813	0.0000	0.0000	0.0000	0.0000	312.0813	312.0813	312.0813	(210)
Space heating fuel (main heating system)	213.9033	165.1127	138.5223	81.2401	36.5779	0.0000	0.0000	0.0000	0.0000	73.8411	148.9237	219.6176	(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	201.0363	177.0251	185.5175	165.7522	162.0320	144.2073	137.9494	152.1264	152.0937	171.9025	182.4632	196.0132	(64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
Fuel for water heating, kWh/month	71.8076	63.2312	66.2645	59.2046	57.8758	51.5090	49.2738	54.3376	54.3260	61.4014	65.1736	70.0135	(219)
Water heating fuel used												724.4187	(219)
Annual totals kWh/year													
Space heating fuel - main system												1077.7386	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												426.0605	(232)
Total delivered energy for all uses												2228.2178	(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	1077.7386	0.5190	559.3464	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	724.4187	0.5190	375.9733	(264)
Space and water heating			935.3197	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	426.0605	0.5190	221.1254	(268)
Total CO2, kg/year			1156.4450	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.3900	(273)

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

DER		12.3900	ZC1
Total Floor Area	TFA	93.3600	
Assumed number of occupants	N	2.6690	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5587	ZC2
CO2 emissions from cooking, equation (L16)		1.9607	ZC3
Total CO2 emissions		29.9095	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		29.9095	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	46.6800 (1b)	x 2.4000 (2b)	= 112.0320 (1b) - (3b)
First floor	46.6800 (1c)	x 2.4000 (2c)	= 112.0320 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 224.0640 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1339 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3839 (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) =							0.3263 (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	0.4160	0.4079	0.3997	0.3589	0.3508	0.3100	0.3100	0.3018	0.3263	0.3508	0.3671	0.3834	(22b)				
Effective ac	0.5865	0.5832	0.5799	0.5644	0.5615	0.5480	0.5480	0.5456	0.5532	0.5615	0.5674	0.5735	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			11.4800	1.3258	15.2197		(27)					
Heat Loss Floor 1			46.6800	0.1300	6.0684		(28a)					
External Wall 1	137.2800	13.5400	123.7400	0.1800	22.2732		(29a)					
External Roof 1	46.6800		46.6800	0.1300	6.0684		(30)					
Total net area of external elements Aum(A, m2)			230.6400				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.6897		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.8574 (36)					
Total fabric heat loss						(33) + (36) =	61.5471 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 43.3698	Feb 43.1213	Mar 42.8777	Apr 41.7337	May 41.5197	Jun 40.5232	Jul 40.5232	Aug 40.3387	Sep 40.9070	Oct 41.5197	Nov 41.9527	Dec 42.4054 (38)
Heat transfer coeff	104.9169	104.6684	104.4248	103.2808	103.0668	102.0703	102.0703	101.8858	102.4541	103.0668	103.4998	103.9525 (39)
Average = Sum(39)m / 12 =												103.2798 (39)
HLP	Jan 1.1238	Feb 1.1211	Mar 1.1185	Apr 1.1063	May 1.1040	Jun 1.0933	Jul 1.0933	Aug 1.0913	Sep 1.0974	Oct 1.1040	Nov 1.1086	Dec 1.1135 (40)
HLP (average)												1.1063 (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												2.6690 (42)
Average daily hot water use (litres/day)												97.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3470	103.4434	99.5399	95.6364	91.7329	87.8293	87.8293	91.7329	95.6364	99.5399	103.4434	107.3470 (44)
Energy conte	159.1925	139.2307	143.6737	125.2582	120.1882	103.7133	96.1056	110.2826	111.5997	130.0587	141.9692	154.1694 (45)
Energy content (annual)											Total = Sum(45)m =	1535.4418 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.8789	20.8846	21.5510	18.7887	18.0282	15.5570	14.4158	16.5424	16.7400	19.5088	21.2954	23.1254 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	208.4351	183.7080	192.9163	172.9124	169.4309	151.3675	145.3483	159.5253	159.2539	179.3014	189.6234	203.4121 (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	208.4351	183.7080	192.9163	172.9124	169.4309	151.3675	145.3483	159.5253	159.2539	179.3014	189.6234	203.4121 (64)
Heat gains from water heating, kWh/month	92.3256	81.8760	87.1656	79.7717	79.3567	72.6080	71.3492	76.0631	75.2303	82.6387	85.3281	90.6555 (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	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	133.4488	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.1253	21.4279	17.4263	13.1929	9.8618	8.3258	8.9963	11.6937	15.6953	19.9287	23.2598	24.7958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.1253	247.6689	241.2590	227.6132	210.3877	194.1982	183.3827	180.8390	187.2489	200.8948	218.1202	234.3097	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	36.3449	(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)	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	-106.7590	(71)
Water heating gains (Table 5)	124.0936	121.8393	117.1581	110.7940	106.6622	100.8445	95.8995	102.2353	104.4865	111.0735	118.5113	121.8487	(72)
Total internal gains	459.3788	456.9707	441.8781	417.6347	392.9464	369.4031	354.3131	360.8027	373.4652	397.9316	425.9259	446.9889	(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					3.5400	10.6334	0.6300	0.7000			0.7700	11.5039 (74)
South					7.9400	46.7521	0.6300	0.7000			0.7700	113.4470 (78)
Solar gains	124.9510	207.7816	274.0297	327.4966	359.5751	354.7854	342.8885	318.6305	292.1478	226.5693	148.6650	107.6189 (83)
Total gains	584.3298	664.7524	715.9078	745.1312	752.5215	724.1885	697.2016	679.4332	665.6131	624.5009	574.5909	554.6078 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	61.7949	61.9416	62.0861	62.7738	62.9042	63.5183	63.5183	63.6333	63.2803	62.9042	62.6410	62.3683
alpha	5.1197	5.1294	5.1391	5.1849	5.1936	5.2346	5.2346	5.2422	5.2187	5.1936	5.1761	5.1579
util living area	0.9976	0.9949	0.9887	0.9712	0.9212	0.7934	0.6196	0.6559	0.8634	0.9738	0.9948	0.9982 (86)
MIT	19.8182	19.9646	20.1841	20.4666	20.7309	20.9200	20.9826	20.9766	20.8657	20.5296	20.1212	19.7920 (87)
Th 2	19.9815	19.9836	19.9857	19.9957	19.9976	20.0063	20.0063	20.0079	20.0029	19.9976	19.9938	19.9899 (88)
util rest of house	0.9968	0.9931	0.9846	0.9596	0.8871	0.7084	0.4920	0.5309	0.7965	0.9611	0.9927	0.9975 (89)
MIT 2	18.4080	18.6230	18.9434	19.3557	19.7188	19.9486	19.9994	19.9977	19.8919	19.4502	18.8594	18.3759 (90)
Living area fraction	18.7455	18.9441	19.2403	19.6215	19.9609	20.1810	20.2347	20.2319	20.1249	19.7085	19.1614	18.7147 (92)
Temperature adjustment	18.7455	18.9441	19.2403	19.6215	19.9609	20.1810	20.2347	20.2319	20.1249	19.7085	19.1614	18.7147 (93)
adjusted MIT	18.7455	18.9441	19.2403	19.6215	19.9609	20.1810	20.2347	20.2319	20.1249	19.7085	19.1614	18.7147 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9953	0.9906	0.9804	0.9541	0.8856	0.7250	0.5228	0.5608	0.8060	0.9562	0.9902	0.9964 (94)
Useful gains	581.5927	658.4895	701.9082	710.9289	666.4121	525.0676	364.4800	381.0241	536.4640	597.1419	568.9555	552.5941 (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	1515.5744	1469.9687	1330.4043	1107.3289	851.4292	569.6584	370.9943	390.4176	617.2764	938.7838	1248.3472	1508.8431 (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	694.8824	545.3140	467.6011	285.4080	137.6527	0.0000	0.0000	0.0000	0.0000	254.1816	489.1621	711.4493 (98)
Space heating												3585.6511 (98)
Space heating per m2												38.4067 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3834.9210 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	694.8824	545.3140	467.6011	285.4080	137.6527	0.0000	0.0000	0.0000	0.0000	254.1816	489.1621	711.4493	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	743.1897	583.2235	500.1081	305.2492	147.2222	0.0000	0.0000	0.0000	0.0000	271.8520	523.1680	760.9083	(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	208.4351	183.7080	192.9163	172.9124	169.4309	151.3675	145.3483	159.5253	159.2539	179.3014	189.6234	203.4121	(64)
Efficiency of water heater (217)m	87.7840	87.5421	87.0894	86.1423	84.2660	79.8000	79.8000	79.8000	79.8000	85.7445	87.2325	87.8801	(216)
Fuel for water heating, kWh/month	237.4409	209.8511	221.5153	200.7287	201.0668	189.6836	182.1407	199.9063	199.5663	209.1113	217.3771	231.4656	(219)
Water heating fuel used												2499.8535	(219)
Annual totals kWh/year													
Space heating fuel - main system												3834.9210	(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)												426.0605	(232)
Total delivered energy for all uses												6835.8350	(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	3834.9210	0.2160	828.3429 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2499.8535	0.2160	539.9684 (264)
Space and water heating			1368.3113 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	426.0605	0.5190	221.1254 (268)
Total CO2, kg/m2/year			1628.3617 (272)
Emissions per m2 for space and water heating			14.6563 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.3685 (272b)
Emissions per m2 for pumps and fans			0.4169 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6563 * 1.55) + 2.3685 + 0.4169, rounded to 2 d.p.			25.5000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE A (2B)			Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (A/2B)	Prop Type Ref	TYPE A / 2 BED / 2 STOREY		
Property	TYPE A / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	86 B	DER	15.08	TER	16.63
Environmental	87 B	% DER<TER	9.33		
CO ₂ Emissions (t/year)	1.40	DFEE	41.39	TFEE	52.40
General Requirements Compliance	Pass	% DFEE<TFEE	21.02		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 112 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.08 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.49 m², No overhang
Windows facing East: 5.06 m², No overhang
Windows facing South: 12.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1486 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(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					
WINDOW (Uw = 1.30)			22.1000	1.2357	27.3099		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			60.8300	0.1100	6.6913		(28a)					
External Wall 1	152.5200	24.1600	128.3600	0.2000	25.6720		(29a)					
External Roof 1	60.8300		60.8300	0.1000	6.0830		(30)					
Total net area of external elements Aum(A, m2)			274.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8162		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							9.5963 (36)					
Total fabric heat loss						(33) + (36) =	77.4125 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7119	Feb 52.3900	Mar 52.0745	Apr 50.5927	May 50.3155	Jun 49.0249	Jul 49.0249	Aug 48.7859	Sep 49.5220	Oct 50.3155	Nov 50.8763	Dec 51.4627 (38)
Heat transfer coeff	130.1243	129.8025	129.4870	128.0052	127.7279	126.4373	126.4373	126.1983	126.9345	127.7279	128.2888	128.8752 (39)
Average = Sum(39)m / 12 =												128.0039 (39)
HLP	Jan 1.1600	Feb 1.1571	Mar 1.1543	Apr 1.1411	May 1.1386	Jun 1.1271	Jul 1.1271	Aug 1.1250	Sep 1.1315	Oct 1.1386	Nov 1.1436	Dec 1.1488 (40)
HLP (average)												1.1411 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)
Daily hot water use	Jan 111.4831	Feb 107.4292	Mar 103.3753	Apr 99.3213	May 95.2674	Jun 91.2135	Jul 91.2135	Aug 95.2674	Sep 99.3213	Oct 103.3753	Nov 107.4292	Dec 111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (46)
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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.7129	13.2749	14.6645	14.1459	14.5736	14.0530	14.4900	14.5442	14.1036	14.6221	14.2006	14.6972 (61)
Solar input	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069 (64)
	58.6492	51.3967	53.2783	46.7896	45.1458	39.3266	36.8089	41.7179	42.0626	48.5663	52.5738	56.9108 (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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	78.8296	76.4832	71.6106	64.9855	60.6798	54.6203	49.4743	56.0725	58.4202	65.2773	73.0191	76.4930	(72)
Total internal gains	446.5891	444.3312	428.1801	401.9313	374.9151	349.1435	332.5656	339.0752	352.7016	379.1823	409.6346	432.8206	(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				4.4900	10.6334	0.4500	0.0000			0.7700			16.5433 (74)
East				5.0600	19.6403	0.4500	0.0000			0.7700			34.4351 (76)
South				12.5500	46.7521	0.4500	0.0000			0.7700			203.3049 (78)

Solar gains	254.2832	431.9383	588.7910	727.4472	814.0514	808.1447	779.1232	714.3105	636.6714	476.6943	304.3303	217.7831	(83)
Total gains	700.8723	876.2696	1016.9711	1129.3785	1188.9665	1157.2882	1111.6887	1053.3857	989.3730	855.8766	713.9650	650.6037	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8680	60.0164	60.1626	60.8591	60.9912	61.6137	61.6137	61.7304	61.3724	60.9912	60.7245	60.4483	
alpha	4.9912	5.0011	5.0108	5.0573	5.0661	5.1076	5.1076	5.1154	5.0915	5.0661	5.0483	5.0299	
util living area	0.9976	0.9924	0.9782	0.9357	0.8348	0.6611	0.4930	0.5390	0.7810	0.9588	0.9941	0.9983	(86)
MIT	19.7683	19.9798	20.2616	20.5873	20.8361	20.9629	20.9931	20.9893	20.9134	20.5740	20.1002	19.7309	(87)
Th 2	19.9522	19.9545	19.9568	19.9674	19.9694	19.9788	19.9788	19.9805	19.9752	19.9694	19.9654	19.9612	(88)
util rest of house	0.9968	0.9899	0.9708	0.9137	0.7821	0.5710	0.3825	0.4257	0.7002	0.9400	0.9917	0.9978	(89)
MIT 2	18.8340	19.0459	19.3250	19.6448	19.8634	19.9625	19.9771	19.9776	19.9306	19.6404	19.1755	18.8039	(90)
Living area fraction									fLA = Living area / (4) =			0.1567	(91)
MIT	18.9804	19.1923	19.4718	19.7925	20.0159	20.1193	20.1363	20.1362	20.0846	19.7867	19.3204	18.9491	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8304	19.0423	19.3218	19.6425	19.8659	19.9693	19.9863	19.9862	19.9346	19.6367	19.1704	18.7991	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	697.7502	864.7922	981.2983	1022.3116	922.7148	659.7371	426.1370	449.1213	689.1775	797.7854	706.1695	648.5617	(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	1890.7558	1835.7004	1660.2545	1375.0911	1043.0086	678.8809	428.1562	452.5687	740.6175	1154.2418	1548.4948	1881.4667	(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	887.5962	652.4503	505.1434	254.0013	89.4986	0.0000	0.0000	0.0000	0.0000	265.2035	606.4742	917.2813	(98)
Space heating												4177.6489	(98)
Space heating per m2												37.2406	(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													4616.1866 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	887.5962	652.4503	505.1434	254.0013	89.4986	0.0000	0.0000	0.0000	0.0000	265.2035	606.4742	917.2813	(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)	980.7693	720.9396	558.1695	280.6644	98.8935	0.0000	0.0000	0.0000	0.0000	293.0426	670.1372	1013.5705	(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	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069	(64)
Efficiency of water heater (217)m	89.9440	89.8583	89.6947	89.3143	88.5239	87.3000	87.3000	87.3000	87.3000	89.3188	89.8073	87.3000	(216)
Fuel for water heating, kWh/month	200.1680	175.6881	182.7021	161.4863	157.4634	139.4759	130.9263	147.8535	148.9157	167.5931	179.9855	194.2901	(219)
Water heating fuel used													1986.5481 (219)
Annual totals kWh/year													
Space heating fuel - main system													4616.1866 (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)													436.1829 (232)
Total delivered energy for all uses													7113.9175 (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	4616.1866	0.2160	997.0963 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1986.5481	0.2160	429.0944 (264)
Space and water heating			1426.1907 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/year			1691.4946 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.0800 (273)

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

DER		15.0800 ZC1
Total Floor Area	TFA	112.1800
Assumed number of occupants	N	2.8273
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.5082 ZC2
CO2 emissions from cooking, equation (L16)		1.6657 ZC3
Total CO2 emissions		31.2539 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		31.2539 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	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											4 * 10 =	40.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000	/ (5) =	0.1486 (8)	
Pressure test												Yes		
Measured/design AP50												5.0000		
Infiltration rate												0.3986 (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) =	0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981 (22b)		
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (25)		

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			22.1000	1.3258	29.2992		(27)					
Heat Loss Floor 1			60.8300	0.1300	7.9079		(28a)					
External Wall 1	152.5200	24.1600	128.3600	0.1800	23.1048		(29a)					
External Roof 1	60.8300		60.8300	0.1300	7.9079		(30)					
Total net area of external elements Aum(A, m2)			274.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.2798		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5308 (36)					
Total fabric heat loss						(33) + (36) =	82.8106 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7119	Feb 52.3900	Mar 52.0745	Apr 50.5927	May 50.3155	Jun 49.0249	Jul 49.0249	Aug 48.7859	Sep 49.5220	Oct 50.3155	Nov 50.8763	Dec 51.4627 (38)
Heat transfer coeff	135.5225	135.2006	134.8852	133.4033	133.1261	131.8355	131.8355	131.5965	132.3326	133.1261	133.6870	134.2733 (39)
Average = Sum(39)m / 12 =												133.4020 (39)
HLP	Jan 1.2081	Feb 1.2052	Mar 1.2024	Apr 1.1892	May 1.1867	Jun 1.1752	Jul 1.1752	Aug 1.1731	Sep 1.1796	Oct 1.1867	Nov 1.1917	Dec 1.1969 (40)
HLP (average)												1.1892 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)
Daily hot water use	Jan 111.4831	Feb 107.4292	Mar 103.3753	Apr 99.3213	May 95.2674	Jun 91.2135	Jul 91.2135	Aug 95.2674	Sep 99.3213	Oct 103.3753	Nov 107.4292	Dec 111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (46)
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 TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.9804	48.5472	44.9820	46.4814	48.5472	48.9804	50.9589	49.3151	50.9589 (61)
Solar input	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (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	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (64)
Heat gains from water heating, kWh/month	67.7107	59.5848	62.3519	55.4982	53.6392	47.0589	44.8067	50.2187	50.7818	57.6505	61.3524	65.9762 (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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	91.0090	88.6679	83.8063	77.0808	72.0957	65.3596	60.2241	67.4982	70.5302	77.4872	85.2116	88.6777	(72)
Total internal gains	458.7686	456.5159	440.3758	414.0266	386.3310	359.8828	343.3154	350.5010	364.8116	391.3922	421.8271	445.0053	(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				4.4900	10.6334		0.6300		0.7000		0.7700		14.5912 (74)
East				5.0600	19.6403		0.6300		0.7000		0.7700		30.3717 (76)
South				12.5500	46.7521		0.6300		0.7000		0.7700		179.3149 (78)
Solar gains	224.2778	380.9696	519.3137	641.6084	717.9933	712.7836	687.1866	630.0219	561.5442	420.4444	268.4194	192.0847	(83)
Total gains	683.0464	837.4856	959.6895	1055.6350	1104.3243	1072.6664	1030.5020	980.5228	926.3558	811.8366	690.2465	637.0900	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.4833	57.6201	57.7549	58.3964	58.5180	59.0909	59.0909	59.1982	58.8689	58.5180	58.2725	58.0181	
alpha	4.8322	4.8413	4.8503	4.8931	4.9012	4.9394	4.9394	4.9465	4.9246	4.9012	4.8848	4.8679	
util living area	0.9979	0.9939	0.9836	0.9528	0.8743	0.7191	0.5480	0.5943	0.8252	0.9684	0.9950	0.9985	(86)
MIT	19.6897	19.8858	20.1609	20.4943	20.7733	20.9396	20.9872	20.9812	20.8762	20.5024	20.0267	19.6555	(87)
Th 2	19.9135	19.9158	19.9181	19.9287	19.9306	19.9399	19.9399	19.9416	19.9363	19.9306	19.9266	19.9224	(88)
util rest of house	0.9971	0.9919	0.9778	0.9352	0.8273	0.6256	0.4236	0.4689	0.7479	0.9531	0.9930	0.9980	(89)
MIT 2	18.1725	18.4597	18.8595	19.3393	19.7088	19.8997	19.9352	19.9340	19.8393	19.3601	18.6739	18.1288	(90)
Living area fraction	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(91)
MIT	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9884	0.9715	0.9266	0.8245	0.6374	0.4431	0.4884	0.7534	0.9455	0.9900	0.9968 (94)
Useful gains	680.0045	827.7975	932.3093	978.1923	910.4603	683.6765	456.5794	478.8687	697.8928	767.6177	683.3105	635.0242 (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	1912.2587	1863.4952	1694.6277	1416.7864	1088.3881	720.1738	461.4365	486.6534	781.0032	1190.0324	1575.6261	1902.3875 (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	916.7971	695.9889	567.1649	315.7878	132.3782	0.0000	0.0000	0.0000	0.0000	314.2765	642.4672	942.9183 (98)
Space heating												4527.7789 (98)
Space heating per m2												40.3617 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4847.7290 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	916.7971	695.9889	567.1649	315.7878	132.3782	0.0000	0.0000	0.0000	0.0000	314.2765	642.4672	942.9183 (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)	981.5815	745.1701	607.2429	338.1026	141.7326	0.0000	0.0000	0.0000	0.0000	336.4845	687.8664	1009.5485 (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	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (64)
Efficiency of water heater (217)m	88.2805	88.0197	87.5281	86.4647	84.3819	80.3000	80.3000	80.3000	80.3000	86.3610	87.8106	80.3000 (216)
Fuel for water heating, kWh/month	244.9977	216.5683	228.6904	207.0959	205.4545	190.1512	182.1793	203.0873	205.3302	215.4083	224.0669	238.8543 (219)
Water heating fuel used												2561.8844 (219)
Annual totals kWh/year												
Space heating fuel - main system												4847.7290 (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)												436.1829 (232)
Total delivered energy for all uses												7920.7963 (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	4847.7290	0.2160	1047.1095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2561.8844	0.2160	553.3670 (264)
Space and water heating			1600.4765 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/m2/year			1865.7804 (272)
Emissions per m2 for space and water heating			14.2670 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0180 (272b)
Emissions per m2 for pumps and fans			0.3470 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2670 * 1.00) + 2.0180 + 0.3470, rounded to 2 d.p.			16.6300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE A (2B)				Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (A/2B)	Prop Type Ref	TYPE A / 2 BED / 2 STOREY			
Property	TYPE A / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	86 B	DER	14.46	TER	16.63	
Environmental	88 B	% DER<TER	13.06			
CO ₂ Emissions (t/year)	1.36	DFEE	41.39	TFEE	52.40	
General Requirements Compliance	Pass	% DFEE<TFEE	21.02			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 112 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.46 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 41.4 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.49 m², No overhang
Windows facing East: 5.06 m², No overhang
Windows facing South: 12.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging ψ -value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1486 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(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					
WINDOW (Uw = 1.30)			22.1000	1.2357	27.3099		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			60.8300	0.1100	6.6913		(28a)					
External Wall 1	152.5200	24.1600	128.3600	0.2000	25.6720		(29a)					
External Roof 1	60.8300		60.8300	0.1000	6.0830		(30)					
Total net area of external elements Aum(A, m2)			274.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8162		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							9.5963 (36)					
Total fabric heat loss						(33) + (36) =	77.4125 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7119	Feb 52.3900	Mar 52.0745	Apr 50.5927	May 50.3155	Jun 49.0249	Jul 49.0249	Aug 48.7859	Sep 49.5220	Oct 50.3155	Nov 50.8763	Dec 51.4627 (38)
Heat transfer coeff	130.1243	129.8025	129.4870	128.0052	127.7279	126.4373	126.4373	126.1983	126.9345	127.7279	128.2888	128.8752 (39)
Average = Sum(39)m / 12 =												128.0039 (39)
HLP	Jan 1.1600	Feb 1.1571	Mar 1.1543	Apr 1.1411	May 1.1386	Jun 1.1271	Jul 1.1271	Aug 1.1250	Sep 1.1315	Oct 1.1386	Nov 1.1436	Dec 1.1488 (40)
HLP (average)												1.1411 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)
Daily hot water use	Jan 111.4831	Feb 107.4292	Mar 103.3753	Apr 99.3213	May 95.2674	Jun 91.2135	Jul 91.2135	Aug 95.2674	Sep 99.3213	Oct 103.3753	Nov 107.4292	Dec 111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.7129	13.2749	14.6645	14.1459	14.5736	14.0530	14.4900	14.5442	14.1036	14.6221	14.2006	14.6972 (61)
Solar input	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069 (64)
	58.6492	51.3967	53.2783	46.7896	45.1458	39.3266	36.8089	41.7179	42.0626	48.5663	52.5738	56.9108 (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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	78.8296	76.4832	71.6106	64.9855	60.6798	54.6203	49.4743	56.0725	58.4202	65.2773	73.0191	76.4930	(72)
Total internal gains	446.5891	444.3312	428.1801	401.9313	374.9151	349.1435	332.5656	339.0752	352.7016	379.1823	409.6346	432.8206	(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					4.4900	10.6334	0.4500	0.0000				0.7700			16.5433	(74)
East					5.0600	19.6403	0.4500	0.0000				0.7700			34.4351	(76)
South					12.5500	46.7521	0.4500	0.0000				0.7700			203.3049	(78)
Solar gains	254.2832	431.9383	588.7910	727.4472	814.0514	808.1447	779.1232	714.3105	636.6714	476.6943	304.3303	217.7831	(83)			
Total gains	700.8723	876.2696	1016.9711	1129.3785	1188.9665	1157.2882	1111.6887	1053.3857	989.3730	855.8766	713.9650	650.6037	(84)			

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8680	60.0164	60.1626	60.8591	60.9912	61.6137	61.6137	61.7304	61.3724	60.9912	60.7245	60.4483	
alpha	4.9912	5.0011	5.0108	5.0573	5.0661	5.1076	5.1076	5.1154	5.0915	5.0661	5.0483	5.0299	
util living area	0.9976	0.9924	0.9782	0.9357	0.8348	0.6611	0.4930	0.5390	0.7810	0.9588	0.9941	0.9983	(86)
MIT	19.7683	19.9798	20.2616	20.5873	20.8361	20.9629	20.9931	20.9893	20.9134	20.5740	20.1002	19.7309	(87)
Th 2	19.9522	19.9545	19.9568	19.9674	19.9694	19.9788	19.9788	19.9805	19.9752	19.9694	19.9654	19.9612	(88)
util rest of house	0.9968	0.9899	0.9708	0.9137	0.7821	0.5710	0.3825	0.4257	0.7002	0.9400	0.9917	0.9978	(89)
MIT 2	18.3144	18.6237	19.0315	19.4948	19.8142	19.9550	19.9763	19.9763	19.9099	19.4875	18.8084	18.2661	(90)
Living area fraction	18.5422	18.8363	19.2243	19.6660	19.9743	20.1129	20.1357	20.1350	20.0672	19.6578	19.0109	18.4957	(91)
MIT	18.5422	18.8363	19.2243	19.6660	19.9743	20.1129	20.1357	20.1350	20.0672	19.6578	19.0109	18.4957	(92)
Temperature adjustment	18.3922	18.6863	19.0743	19.5160	19.8243	19.9629	19.9857	19.9850	19.9172	19.5078	18.8609	18.3457	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	697.2994	863.5136	978.5973	1018.3301	919.7944	659.0444	426.0561	448.9850	687.6326	794.9118	705.2634	648.2502	(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	1833.7417	1789.4898	1628.2022	1358.9065	1037.7033	678.0766	428.0731	452.4265	738.4024	1137.7751	1508.7869	1823.0265	(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	845.5131	622.2560	483.3060	245.2151	87.7242	0.0000	0.0000	0.0000	0.0000	255.0903	578.5369	874.0336	(98)
Space heating												3991.6751	(98)
Space heating per m2												35.5828	(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 %)													92.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4296.7440 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	845.5131	622.2560	483.3060	245.2151	87.7242	0.0000	0.0000	0.0000	0.0000	255.0903	578.5369	874.0336	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	910.1325	669.8127	520.2433	263.9559	94.4286	0.0000	0.0000	0.0000	0.0000	274.5859	622.7523	940.8327	(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	180.0392	157.8703	163.8741	144.2304	139.3928	121.7625	114.2987	129.0761	130.0034	149.6921	161.6400	174.8069	(64)
Efficiency of water heater (217)m	89.9214	89.8336	89.6677	89.2879	88.5088	87.3000	87.3000	87.3000	87.3000	89.2896	89.7813	89.9505	(216)
Fuel for water heating, kWh/month	200.2185	175.7363	182.7570	161.5341	157.4903	139.4759	130.9263	147.8535	148.9157	167.6478	180.0375	194.3368	(219)
Water heating fuel used												1986.9296	(219)
Annual totals kWh/year													
Space heating fuel - main system												4296.7440	(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)												436.1829	(232)
Total delivered energy for all uses												6794.8564	(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	4296.7440	0.2160	928.0967 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1986.9296	0.2160	429.1768 (264)
Space and water heating			1357.2735 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/year			1622.5774 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.4600 (273)

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

DER		14.4600	ZC1
Total Floor Area	TFA	112.1800	
Assumed number of occupants	N	2.8273	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.5082	ZC2
CO2 emissions from cooking, equation (L16)		1.6657	ZC3
Total CO2 emissions		30.6339	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		30.6339	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	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1486 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			22.1000	1.3258	29.2992		(27)					
Heat Loss Floor 1			60.8300	0.1300	7.9079		(28a)					
External Wall 1	152.5200	24.1600	128.3600	0.1800	23.1048		(29a)					
External Roof 1	60.8300		60.8300	0.1300	7.9079		(30)					
Total net area of external elements Aum(A, m2)			274.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.2798		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5308 (36)					
Total fabric heat loss						(33) + (36) =	82.8106 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7119	Feb 52.3900	Mar 52.0745	Apr 50.5927	May 50.3155	Jun 49.0249	Jul 49.0249	Aug 48.7859	Sep 49.5220	Oct 50.3155	Nov 50.8763	Dec 51.4627 (38)
Heat transfer coeff	135.5225	135.2006	134.8852	133.4033	133.1261	131.8355	131.8355	131.5965	132.3326	133.1261	133.6870	134.2733 (39)
Average = Sum(39)m / 12 =												133.4020 (39)
HLP	Jan 1.2081	Feb 1.2052	Mar 1.2024	Apr 1.1892	May 1.1867	Jun 1.1752	Jul 1.1752	Aug 1.1731	Sep 1.1796	Oct 1.1867	Nov 1.1917	Dec 1.1969 (40)
HLP (average)												1.1892 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)
Daily hot water use	Jan 111.4831	Feb 107.4292	Mar 103.3753	Apr 99.3213	May 95.2674	Jun 91.2135	Jul 91.2135	Aug 95.2674	Sep 99.3213	Oct 103.3753	Nov 107.4292	Dec 111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (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												

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Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.9804	48.5472	44.9820	46.4814	48.5472	48.9804	50.9589	49.3151	50.9589 (61)
Solar input	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (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	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (64)
Heat gains from water heating, kWh/month	67.7107	59.5848	62.3519	55.4982	53.6392	47.0589	44.8067	50.2187	50.7818	57.6505	61.3524	65.9762 (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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	91.0090	88.6679	83.8063	77.0808	72.0957	65.3596	60.2241	67.4982	70.5302	77.4872	85.2116	88.6777	(72)
Total internal gains	458.7686	456.5159	440.3758	414.0266	386.3310	359.8828	343.3154	350.5010	364.8116	391.3922	421.8271	445.0053	(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				4.4900	10.6334		0.6300		0.7000		0.7700		14.5912 (74)
East				5.0600	19.6403		0.6300		0.7000		0.7700		30.3717 (76)
South				12.5500	46.7521		0.6300		0.7000		0.7700		179.3149 (78)
Solar gains	224.2778	380.9696	519.3137	641.6084	717.9933	712.7836	687.1866	630.0219	561.5442	420.4444	268.4194	192.0847	(83)
Total gains	683.0464	837.4856	959.6895	1055.6350	1104.3243	1072.6664	1030.5020	980.5228	926.3558	811.8366	690.2465	637.0900	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	57.4833	57.6201	57.7549	58.3964	58.5180	59.0909	59.0909	59.1982	58.8689	58.5180	58.2725	58.0181	
alpha	4.8322	4.8413	4.8503	4.8931	4.9012	4.9394	4.9394	4.9465	4.9246	4.9012	4.8848	4.8679	
util living area	0.9979	0.9939	0.9836	0.9528	0.8743	0.7191	0.5480	0.5943	0.8252	0.9684	0.9950	0.9985	(86)
MIT	19.6897	19.8858	20.1609	20.4943	20.7733	20.9396	20.9872	20.9812	20.8762	20.5024	20.0267	19.6555	(87)
Th 2	19.9135	19.9158	19.9181	19.9287	19.9306	19.9399	19.9399	19.9416	19.9363	19.9306	19.9266	19.9224	(88)
util rest of house	0.9971	0.9919	0.9778	0.9352	0.8273	0.6256	0.4236	0.4689	0.7479	0.9531	0.9930	0.9980	(89)
MIT 2	18.1725	18.4597	18.8595	19.3393	19.7088	19.8997	19.9352	19.9340	19.8393	19.3601	18.6739	18.1288	(90)
Living area fraction	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(91)
MIT	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4103	18.6832	19.0635	19.5203	19.8756	20.0627	20.1001	20.0981	20.0018	19.5391	18.8859	18.3680	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9955	0.9884	0.9715	0.9266	0.8245	0.6374	0.4431	0.4884	0.7534	0.9455	0.9900	0.9968 (94)
Useful gains	680.0045	827.7975	932.3093	978.1923	910.4603	683.6765	456.5794	478.8687	697.8928	767.6177	683.3105	635.0242 (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	1912.2587	1863.4952	1694.6277	1416.7864	1088.3881	720.1738	461.4365	486.6534	781.0032	1190.0324	1575.6261	1902.3875 (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	916.7971	695.9889	567.1649	315.7878	132.3782	0.0000	0.0000	0.0000	0.0000	314.2765	642.4672	942.9183 (98)
Space heating												4527.7789 (98)
Space heating per m2												40.3617 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4847.7290 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	916.7971	695.9889	567.1649	315.7878	132.3782	0.0000	0.0000	0.0000	0.0000	314.2765	642.4672	942.9183 (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)	981.5815	745.1701	607.2429	338.1026	141.7326	0.0000	0.0000	0.0000	0.0000	336.4845	687.8664	1009.5485 (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	216.2852	190.6228	200.1684	179.0649	173.3664	152.6914	146.2900	163.0791	164.8801	186.0289	196.7545	211.0686 (64)
Efficiency of water heater (217)m	88.2805	88.0197	87.5281	86.4647	84.3819	80.3000	80.3000	80.3000	80.3000	86.3610	87.8106	80.3000 (216)
Fuel for water heating, kWh/month	244.9977	216.5683	228.6904	207.0959	205.4545	190.1512	182.1793	203.0873	205.3302	215.4083	224.0669	238.8543 (219)
Water heating fuel used												2561.8844 (219)
Annual totals kWh/year												
Space heating fuel - main system												4847.7290 (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)												436.1829 (232)
Total delivered energy for all uses												7920.7963 (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	4847.7290	0.2160	1047.1095 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2561.8844	0.2160	553.3670 (264)
Space and water heating			1600.4765 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/m2/year			1865.7804 (272)
Emissions per m2 for space and water heating			14.2670 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0180 (272b)
Emissions per m2 for pumps and fans			0.3470 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2670 * 1.00) + 2.0180 + 0.3470, rounded to 2 d.p.			16.6300 (273)

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Property Reference	BEE/0008/21 TYPE A (2B)				Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (A/2B)	Prop Type Ref	TYPE A / 2 BED / 2 STOREY			
Property	TYPE A / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	90 B	DER	10.27	TER	24.01	
Environmental	91 B	% DER<TER	57.22			
CO ₂ Emissions (t/year)	1.00	DFEE	41.39	TFEE	52.40	
General Requirements Compliance	Pass	% DFEE<TFEE	21.02			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

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

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

DWELLING AS DESIGNED

Detached House, total floor area 112 m²

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

1a TER and DER

Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.01 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 10.27 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.27 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.11 kWh/day
Permitted by DBSCG 2.10 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading: Average
Windows facing North: 4.49 m², No overhang
Windows facing East: 5.06 m², No overhang
Windows facing South: 12.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

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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	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1486 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3986 (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) =	0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981 (22b)
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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
WINDOW (Uw = 1.30)			22.1000	1.2357	27.3099		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			60.8300	0.1100	6.6913		(28a)
External Wall 1	152.5200	24.1600	128.3600	0.2000	25.6720		(29a)
External Roof 1	60.8300		60.8300	0.1000	6.0830		(30)
Total net area of external elements Aum(A, m ²)			274.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8162		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							9.5963 (36)
Total fabric heat loss						(33) + (36) =	77.4125 (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	52.7119	52.3900	52.0745	50.5927	50.3155	49.0249	49.0249	48.7859	49.5220	50.3155	50.8763	51.4627 (38)
Heat transfer coeff	130.1243	129.8025	129.4870	128.0052	127.7279	126.4373	126.4373	126.1983	126.9345	127.7279	128.2888	128.8752 (39)
Average = Sum(39)m / 12 =												128.0039 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1600	1.1571	1.1543	1.1411	1.1386	1.1271	1.1271	1.1250	1.1315	1.1386	1.1436	1.1488 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4831	107.4292	103.3753	99.3213	95.2674	91.2135	91.2135	95.2674	99.3213	103.3753	107.4292	111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)

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Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	207.1701	182.3898	191.0533	170.5785	166.6630	148.2034	141.6524	156.3757	156.3937	176.9138	187.9334	201.9535	(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	207.1701	182.3898	191.0533	170.5785	166.6630	148.2034	141.6524	156.3757	156.3937	176.9138	187.9334	201.9535	(64)
Heat gains from water heating, kWh/month	88.4460	78.3135	83.0872	75.6483	74.9774	68.2086	66.6614	71.5569	70.9319	78.3858	81.4188	86.7115	(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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	118.8791	116.5379	111.6764	105.0671	100.7761	94.7342	89.5987	96.1786	98.5165	105.3573	113.0817	116.5477	(72)
Total internal gains	483.6386	481.3860	465.2458	439.0129	412.0114	386.2573	369.6900	376.1814	389.7978	416.2623	446.6972	469.8753	(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					4.4900	10.6334		0.4500	0.0000	0.7700		16.5433 (74)	
East					5.0600	19.6403		0.4500	0.0000	0.7700		34.4351 (76)	
South					12.5500	46.7521		0.4500	0.0000	0.7700		203.3049 (78)	

Solar gains	254.2832	431.9383	588.7910	727.4472	814.0514	808.1447	779.1232	714.3105	636.6714	476.6943	304.3303	217.7831	(83)
Total gains	737.9218	913.3243	1054.0368	1166.4601	1226.0628	1194.4020	1148.8131	1090.4919	1026.4693	892.9565	751.0275	687.6585	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.8680	60.0164	60.1626	60.8591	60.9912	61.6137	61.6137	61.7304	61.3724	60.9912	60.7245	60.4483	
alpha	4.9912	5.0011	5.0108	5.0573	5.0661	5.1076	5.1076	5.1154	5.0915	5.0661	5.0483	5.0299	
util living area	0.9970	0.9910	0.9749	0.9283	0.8217	0.6445	0.4780	0.5222	0.7632	0.9518	0.9926	0.9979	(86)
Tweekday	18.3588	18.6665	19.0700	19.5232	19.8275	19.9578	19.9767	19.9769	19.9176	19.5201	18.8517	18.3109	
Tweekend	20.2235	20.3596	20.5403	20.7473	20.9021	20.9786	20.9961	20.9940	20.9498	20.7405	20.4377	20.1994	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.8016	20.0094	20.2906	20.6055	20.8489	20.9671	20.9940	20.9907	20.9216	20.5996	20.1220	19.7644	(87)
Th 2	19.9522	19.9545	19.9568	19.9674	19.9694	19.9788	19.9788	19.9805	19.9752	19.9694	19.9654	19.9612	(88)
util rest of house	0.9960	0.9880	0.9665	0.9045	0.7673	0.5551	0.3704	0.4117	0.6810	0.9307	0.9897	0.9971	(89)
Tweekday	18.3588	18.6665	19.0700	19.5232	19.8275	19.9578	19.9767	19.9769	19.9176	19.5201	18.8517	18.3109	
Tweekend	18.3588	18.6665	19.0700	19.5232	19.8275	19.9578	19.9767	19.9769	19.9176	19.5201	18.8517	18.3109	
MIT 2	18.3588	18.6665	19.0700	19.5232	19.8275	19.9578	19.9767	19.9769	19.9176	19.5201	18.8517	18.3109	(90)
Living area fraction	fLA = Living area / (4) =												0.1567 (91)
MIT	18.5849	18.8770	19.2613	19.6928	19.9876	20.1160	20.1361	20.1358	20.0750	19.6893	19.0508	18.5387	(92)
Temperature adjustment													0.0000
adjusted MIT	18.5849	18.8770	19.2613	19.6928	19.9876	20.1160	20.1361	20.1358	20.0750	19.6893	19.0508	18.5387	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9940	0.9837	0.9592	0.8968	0.7684	0.5677	0.3873	0.4289	0.6898	0.9233	0.9859	0.9956	(94)
Ext temp.	733.4811	898.4287	1011.0433	1046.1163	942.0600	678.1112	444.8832	467.7569	708.0303	824.4860	740.4454	684.6593	(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	1858.8166	1814.2447	1652.4255	1381.5392	1058.5580	697.4235	447.0928	471.4480	758.4281	1160.9540	1533.1478	1847.9047	(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	837.2496	615.4283	477.1883	241.5045	86.6746	0.0000	0.0000	0.0000	0.0000	250.3322	570.7457	865.4546	(98)
Space heating per m2	(98) / (4) =												35.1629 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)														0.0000	(201)
Fraction of space heat from main system(s)														1.0000	(202)
Efficiency of main space heating system 1 (in %)														380.0231	(206)
Efficiency of secondary/supplementary heating system, %														100.0000	(208)
Space heating requirement														1037.9837	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	837.2496	615.4283	477.1883	241.5045	86.6746	0.0000	0.0000	0.0000	0.0000	250.3322	570.7457	865.4546	(98)		
Space heating efficiency (main heating system 1)	380.0231	380.0231	380.0231	380.0231	380.0231	0.0000	0.0000	0.0000	0.0000	380.0231	380.0231	380.0231	(210)		
Space heating fuel (main heating system)	220.3155	161.9450	125.5682	63.5499	22.8077	0.0000	0.0000	0.0000	0.0000	65.8729	150.1871	227.7374	(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	207.1701	182.3898	191.0533	170.5785	166.6630	148.2034	141.6524	156.3757	156.3937	176.9138	187.9334	201.9535	(64)		
Efficiency of water heater (217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)		
Fuel for water heating, kWh/month	73.9986	65.1474	68.2419	60.9285	59.5299	52.9364	50.5965	55.8554	55.8619	63.1914	67.1275	72.1353	(219)		
Water heating fuel used												745.5505	(219)		
Annual totals kWh/year															
Space heating fuel - main system												1037.9837	(211)		
Space heating fuel - secondary												0.0000	(215)		
Electricity for pumps and fans:															
Total electricity for the above, kWh/year												0.0000	(231)		
Electricity for lighting (calculated in Appendix L)												436.1829	(232)		
Total delivered energy for all uses												2219.7172	(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	1037.9837	0.5190	538.7136 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	745.5505	0.5190	386.9407 (264)
Space and water heating			925.6543 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/year			1152.0332 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.2700 (273)

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

DER			10.2700	ZC1
Total Floor Area	TFA		112.1800	
Assumed number of occupants	N		2.8273	
CO2 emission factor in Table 12 for electricity displaced from grid	EF		0.5190	
CO2 emissions from appliances, equation (L14)			14.5082	ZC2
CO2 emissions from cooking, equation (L16)			1.6657	ZC3
Total CO2 emissions			26.4439	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			26.4439	ZC8

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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	60.8300 (1b)	x 2.4000 (2b)	= 145.9920 (1b) - (3b)
First floor	51.3500 (1c)	x 2.4000 (2c)	= 123.2400 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.1800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 269.2320 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) =	0.1486 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3986 (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) =					0.3388 (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	0.4320	0.4235	0.4150	0.3727	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981	(22b)				
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			22.1000	1.3258	29.2992		(27)					
Heat Loss Floor 1			60.8300	0.1300	7.9079		(28a)					
External Wall 1	152.5200	24.1600	128.3600	0.1800	23.1048		(29a)					
External Roof 1	60.8300		60.8300	0.1300	7.9079		(30)					
Total net area of external elements Aum(A, m2)			274.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.2798		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.5308 (36)					
Total fabric heat loss						(33) + (36) =	82.8106 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 52.7119	Feb 52.3900	Mar 52.0745	Apr 50.5927	May 50.3155	Jun 49.0249	Jul 49.0249	Aug 48.7859	Sep 49.5220	Oct 50.3155	Nov 50.8763	Dec 51.4627 (38)
Heat transfer coeff	135.5225	135.2006	134.8852	133.4033	133.1261	131.8355	131.8355	131.5965	132.3326	133.1261	133.6870	134.2733 (39)
Average = Sum(39)m / 12 =												133.4020 (39)
HLP	Jan 1.2081	Feb 1.2052	Mar 1.2024	Apr 1.1892	May 1.1867	Jun 1.1752	Jul 1.1752	Aug 1.1731	Sep 1.1796	Oct 1.1867	Nov 1.1917	Dec 1.1969 (40)
HLP (average)												1.1892 (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												2.8273 (42)
Average daily hot water use (litres/day)												101.3483 (43)
Daily hot water use	Jan 111.4831	Feb 107.4292	Mar 103.3753	Apr 99.3213	May 95.2674	Jun 91.2135	Jul 91.2135	Aug 95.2674	Sep 99.3213	Oct 103.3753	Nov 107.4292	Dec 111.4831 (44)
Energy conte	165.3263	144.5954	149.2095	130.0845	124.8192	107.7094	99.8086	114.5319	115.8997	135.0700	147.4394	160.1097 (45)
Energy content (annual)										Total = Sum(45)m =		1594.6036 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7989	21.6893	22.3814	19.5127	18.7229	16.1564	14.9713	17.1798	17.3850	20.2605	22.1159	24.0165 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage												
	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	214.5689	189.0727	198.4522	177.7387	174.0618	155.3636	149.0513	163.7745	163.5539	184.3126	195.0936	209.3523 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h												
	214.5689	189.0727	198.4522	177.7387	174.0618	155.3636	149.0513	163.7745	163.5539	184.3126	195.0936	209.3523 (64)
												Total per year (kWh/year) = Sum(64)m = 2174.3963 (64)
Heat gains from water heating, kWh/month												
	94.3651	83.6598	89.0063	81.3764	80.8965	73.9367	72.5805	77.4760	76.6600	84.3049	87.1470	92.6306 (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	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	141.3649	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.6985	21.9370	17.8403	13.5063	10.0961	8.5236	9.2100	11.9715	16.0681	20.4022	23.8124	25.3849	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	274.6516	277.5016	270.3196	255.0301	235.7298	217.5902	205.4718	202.6218	209.8038	225.0933	244.3937	262.5332	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	37.1365	(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)	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	-113.0919	(71)
Water heating gains (Table 5)	126.8348	124.4937	119.6321	113.0228	108.7319	102.6899	97.5544	104.1344	106.4722	113.3130	121.0375	124.5035	(72)
Total internal gains	494.5944	492.3418	476.2016	449.9687	422.9672	397.2131	380.6457	387.1372	400.7536	427.2180	457.6529	480.8311	(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					4.4900	10.6334		0.6300	0.7000	0.7700		14.5912 (74)	
East					5.0600	19.6403		0.6300	0.7000	0.7700		30.3717 (76)	
South					12.5500	46.7521		0.6300	0.7000	0.7700		179.3149 (78)	

Solar gains	224.2778	380.9696	519.3137	641.6084	717.9933	712.7836	687.1866	630.0219	561.5442	420.4444	268.4194	192.0847	(83)
Total gains	718.8722	873.3114	995.5153	1091.5771	1140.9605	1109.9967	1067.8324	1017.1590	962.2978	847.6624	726.0723	672.9158	(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	57.4833	57.6201	57.7549	58.3964	58.5180	59.0909	59.0909	59.1982	58.8689	58.5180	58.2725	58.0181
alpha	4.8322	4.8413	4.8503	4.8931	4.9012	4.9394	4.9394	4.9465	4.9246	4.9012	4.8848	4.8679
util living area	0.9973	0.9928	0.9811	0.9470	0.8626	0.7016	0.5307	0.5758	0.8087	0.9629	0.9938	0.9981 (86)
MIT	19.7190	19.9144	20.1880	20.5175	20.7888	20.9459	20.9889	20.9836	20.8877	20.5274	20.0556	19.6850 (87)
Th 2	19.9135	19.9158	19.9181	19.9287	19.9306	19.9399	19.9399	19.9416	19.9363	19.9306	19.9266	19.9224 (88)
util rest of house	0.9964	0.9903	0.9745	0.9276	0.8133	0.6080	0.4093	0.4529	0.7289	0.9455	0.9913	0.9974 (89)
MIT 2	18.2152	18.5012	18.8980	19.3702	19.7263	19.9043	19.9359	19.9350	19.8499	19.3938	18.7158	18.1718 (90)
Living area fraction									fLA = Living area / (4) =			0.1567 (91)
MIT	18.4509	18.7227	19.1002	19.5500	19.8928	20.0676	20.1009	20.0994	20.0125	19.5715	18.9257	18.4089 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4509	18.7227	19.1002	19.5500	19.8928	20.0676	20.1009	20.0994	20.0125	19.5715	18.9257	18.4089 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9945	0.9864	0.9676	0.9191	0.8113	0.6201	0.4283	0.4720	0.7354	0.9377	0.9878	0.9959	(94)
Useful gains	714.9381	861.4756	963.3009	1003.2444	925.6545	688.3608	457.3551	480.1078	707.7034	794.8426	717.2073	670.1814	(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	1917.7632	1868.8345	1699.5793	1420.7478	1090.6776	720.8193	461.5431	486.8222	782.4166	1194.3385	1580.9450	1907.8773	(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	894.9018	676.9451	547.7911	300.6024	122.7772	0.0000	0.0000	0.0000	0.0000	297.2249	621.8911	920.8458	(98)
Space heating												4382.9795	(98)
Space heating per m2												(98) / (4) = 39.0710	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4687.6786 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	894.9018	676.9451	547.7911	300.6024	122.7772	0.0000	0.0000	0.0000	0.0000	297.2249	621.8911	920.8458 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	957.1143	724.0055	585.8729	321.4999	131.3125	0.0000	0.0000	0.0000	0.0000	317.8876	665.1242	984.8618 (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	214.5689	189.0727	198.4522	177.7387	174.0618	155.3636	149.0513	163.7745	163.5539	184.3126	195.0936	209.3523 (64)
Efficiency of water heater (217)m	88.2125	87.9260	87.3841	86.2051	83.9031	79.8000	79.8000	79.8000	79.8000	86.0821	87.6922	79.8000 (216)
Fuel for water heating, kWh/month	243.2410	215.0360	227.1034	206.1813	207.4558	194.6913	186.7811	205.2312	204.9548	214.1127	222.4755	88.3067 (217)
Water heating fuel used												237.0741 (219)
Annual totals kWh/year												2564.3383 (219)
Space heating fuel - main system												4687.6786 (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)												436.1829 (232)
Total delivered energy for all uses												7763.1997 (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	4687.6786	0.2160	1012.5386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2564.3383	0.2160	553.8971 (264)
Space and water heating			1566.4356 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	436.1829	0.5190	226.3789 (268)
Total CO2, kg/m2/year			1831.7396 (272)
Emissions per m2 for space and water heating			13.9636 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.0180 (272b)
Emissions per m2 for pumps and fans			0.3470 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9636 * 1.55) + 2.0180 + 0.3470, rounded to 2 d.p.			24.0100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (2B)			Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (B/2B)	Prop Type Ref	TYPE B / 2 BED / 2 STOREY		
Property	TYPE B / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	86 B	DER	14.90	TER	16.39
Environmental	87 B	% DER<TER	9.07		
CO ₂ Emissions (t/year)	1.47	DFEE	41.68	TFEE	52.69
General Requirements Compliance	Pass	% DFEE<TFEE	20.90		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 119 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.90 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.30 m², No overhang
Windows facing East: 5.06 m², No overhang
Windows facing South: 12.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 285.8880 (5)
Dwelling volume			

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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1399 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3899 (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) =	0.3314 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894 (22b)
	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758 (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
WINDOW (Uw = 1.30)			23.9100	1.2357	29.5466		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			64.4200	0.1100	7.0862		(28a)
External Wall 1	156.7400	25.9700	130.7700	0.2000	26.1540		(29a)
External Roof 1	64.4200		64.4200	0.1000	6.4420		(30)
Total net area of external elements Aum(A, m ²)			285.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.2888		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							9.9953 (36)
Total fabric heat loss						(33) + (36) =	81.2841 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	55.5947	55.2677	54.9470	53.4412	53.1594	51.8478	51.8478
Heat transfer coeff	136.8788	136.5517	136.2311	134.7252	134.4435	133.1319	133.1319
Average = Sum(39)m / 12 =							134.7239 (39)
HLP	1.1491	1.1463	1.1436	1.1310	1.1286	1.1176	1.1176
HLP (average)							1.1310 (40)
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
Daily hot water use	112.3336	108.2487	104.1639	100.0790	95.9941	91.9093	91.9093	95.9941	100.0790	104.1639	108.2487	112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)										Total = Sum(45)m =		1606.7676 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (46)
Total storage loss												
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 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.7167	13.2782	14.6680	14.1515	14.5791	14.0576	14.4942	14.5493	14.1087	14.6252	14.2040	14.7009 (61)
Solar input	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (64)
	59.0695	51.7643	53.6576	47.1209	45.4637	39.6010	37.0631	42.0097	42.3578	48.9097	52.9486	57.3178 (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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	79.3945	77.0302	72.1204	65.4457	61.1072	55.0013	49.8160	56.4646	58.8303	65.7388	73.5397	77.0400	(72)
Total internal gains	457.8487	455.5817	439.0154	412.0536	384.2335	357.7433	340.7329	347.2842	361.3064	388.5019	419.7845	443.6691	(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					6.3000	10.6334	0.4500	0.0000			0.7700			23.2122 (74)
East					5.0600	19.6403	0.4500	0.0000			0.7700			34.4351 (76)
South					12.5500	46.7521	0.4500	0.0000			0.7700			203.3049 (78)
Solar gains	260.9521	444.6829	610.4472	762.2325	860.9105	858.3087	825.9577	751.4677	662.7092	491.8651	312.5573	223.3427	(83)	
Total gains	718.8008	900.2646	1049.4626	1174.2862	1245.1440	1216.0520	1166.6905	1098.7519	1024.0155	880.3670	732.3417	667.0118	(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	60.4346	60.5794	60.7220	61.4007	61.5294	62.1355	62.1355	62.2491	61.9006	61.5294	61.2696	61.0004	
alpha	5.0290	5.0386	5.0481	5.0934	5.1020	5.1424	5.1424	5.1499	5.1267	5.1020	5.0846	5.0667	
util living area	0.9980	0.9934	0.9803	0.9392	0.8378	0.6627	0.4947	0.5440	0.7900	0.9628	0.9949	0.9986	(86)
MIT	19.7631	19.9711	20.2529	20.5828	20.8361	20.9634	20.9932	20.9892	20.9103	20.5642	20.0921	19.7263	(87)
Th 2	19.9609	19.9632	19.9653	19.9756	19.9775	19.9865	19.9865	19.9881	19.9830	19.9775	19.9736	19.9696	(88)
util rest of house	0.9973	0.9912	0.9736	0.9181	0.7858	0.5730	0.3846	0.4306	0.7104	0.9456	0.9928	0.9981	(89)
MIT 2	18.8358	19.0444	19.3239	19.6480	19.8712	19.9704	19.9848	19.9852	19.9365	19.6386	19.1741	18.8060	(90)
Living area fraction	18.9920	19.2005	19.4803	19.8054	20.0337	20.1376	20.1546	20.1543	20.1005	19.7944	19.3287	18.9610	(91)
MIT	18.9920	19.2005	19.4803	19.8054	20.0337	20.1376	20.1546	20.1543	20.1005	19.7944	19.3287	18.9610	(92)
Temperature adjustment	18.8420	19.0505	19.3303	19.6554	19.8837	19.9876	20.0046	20.0043	19.9505	19.6444	19.1787	18.8110	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9962	0.9885	0.9681	0.9100	0.7804	0.5732	0.3867	0.4325	0.7075	0.9383	0.9905	0.9973	(94)
Ext temp.	716.0567	889.9127	1016.0048	1068.6297	971.7228	696.9908	451.1134	475.1904	724.5031	826.0227	725.4026	665.2304	(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	1990.4911	1932.2688	1747.8894	1449.0278	1100.2396	717.2649	453.2640	478.9684	781.8399	1215.9668	1630.7865	1981.3831	(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	948.1792	700.4633	544.5221	273.8866	95.6165	0.0000	0.0000	0.0000	0.0000	290.1185	651.8764	979.2176	(98)
Space heating per m2												4483.8801	(98)
												37.6417	(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												4954.5637 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	948.1792	700.4633	544.5221	273.8866	95.6165	0.0000	0.0000	0.0000	0.0000	290.1185	651.8764	979.2176 (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)	1047.7118	773.9926	601.6819	302.6371	105.6536	0.0000	0.0000	0.0000	0.0000	320.5729	720.3054	1082.0084 (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	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (64)
Efficiency of water heater (217)m	89.9706	89.8905	89.7350	89.3649	88.5690	87.3000	87.3000	87.3000	87.3000	89.3798	89.8420	87.3000 (216)
Fuel for water heating, kWh/month	201.5148	176.8558	183.8922	162.5115	158.4645	140.4223	131.8032	148.8600	149.9341	168.6348	181.1715	195.5968 (219)
Water heating fuel used												1999.6615 (219)
Annual totals kWh/year												
Space heating fuel - main system												4954.5637 (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)												450.2204 (232)
Total delivered energy for all uses												7479.4456 (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	4954.5637	0.2160	1070.1858 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1999.6615	0.2160	431.9269 (264)
Space and water heating			1502.1127 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/year			1774.7020 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.9000 (273)

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

DER		14.9000 ZC1
Total Floor Area	TFA	119.1200
Assumed number of occupants	N	2.8598
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		14.1311 ZC2
CO2 emissions from cooking, equation (L16)		1.5752 ZC3
Total CO2 emissions		30.6063 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		30.6063 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	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 285.8880 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1399 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3899 (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) =		0.3314 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894 (22b)
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			23.9100	1.3258	31.6989		(27)
Heat Loss Floor 1			64.4200	0.1300	8.3746		(28a)
External Wall 1	156.7400	25.9700	130.7700	0.1800	23.5386		(29a)
External Roof 1	64.4200		64.4200	0.1300	8.3746		(30)
Total net area of external elements Aum(A, m ²)			285.5800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.0467		(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)							12.8864 (36)
Total fabric heat loss						(33) + (36) =	86.9331 (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	55.5947	55.2677	54.9470	53.4412	53.1594	51.8478	51.8478	51.6050	52.3530	53.1594	53.7294	54.3253 (38)
Heat transfer coeff	142.5278	142.2007	141.8801	140.3742	140.0925	138.7809	138.7809	138.5380	139.2861	140.0925	140.6624	141.2583 (39)
Average = Sum(39)m / 12 =												140.3729 (39)
HLP	1.1965	1.1938	1.1911	1.1784	1.1761	1.1651	1.1651	1.1630	1.1693	1.1761	1.1808	1.1858 (40)
HLP (average)												1.1784 (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												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
Daily hot water use	112.3336	108.2487	104.1639	100.0790	95.9941	91.9093	91.9093	95.9941	100.0790	104.1639	108.2487	112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)										Total = Sum(45)m =		1606.7676 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (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 TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	48.9176	45.3251	46.8360	48.9176	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899 (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	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899 (64)
Heat gains from water heating, kWh/month	68.1300	59.9516	62.7303	55.9118	54.0483	47.4179	45.1485	50.6017	51.1594	57.9931	61.7263	66.3823 (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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	91.5726	89.2137	84.3150	77.6553	72.6456	65.8581	60.6835	68.0131	71.0547	77.9477	85.7310	89.2235	(72)
Total internal gains	470.0268	467.7651	451.2099	424.2632	395.7719	368.6001	351.6004	358.8327	373.5308	400.7108	431.9758	455.8526	(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				6.3000	10.6334	0.6300	0.7000	0.7700	20.4731 (74)			
East				5.0600	19.6403	0.6300	0.7000	0.7700	30.3717 (76)			
South				12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)			
Solar gains	230.1598	392.2103	538.4144	672.2891	759.3231	757.0283	728.4947	662.7945	584.5095	433.8250	275.6755	196.9882 (83)
Total gains	700.1866	859.9755	989.6244	1096.5523	1155.0950	1125.6284	1080.0951	1021.6272	958.0403	834.5358	707.6513	652.8408 (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	58.0394	58.1729	58.3043	58.9298	59.0483	59.6063	59.6063	59.7108	59.3901	59.0483	58.8090	58.5610	
alpha	4.8693	4.8782	4.8870	4.9287	4.9366	4.9738	4.9738	4.9807	4.9593	4.9366	4.9206	4.9041	
util living area	0.9982	0.9947	0.9853	0.9557	0.8774	0.7214	0.5505	0.6000	0.8335	0.9717	0.9957	0.9987	(86)
MIT	19.6856	19.8784	20.1531	20.4897	20.7729	20.9401	20.9873	20.9809	20.8723	20.4930	20.0195	19.6518	(87)
Th 2	19.9228	19.9250	19.9272	19.9373	19.9392	19.9481	19.9481	19.9497	19.9446	19.9392	19.9354	19.9313	(88)
util rest of house	0.9975	0.9929	0.9800	0.9389	0.8312	0.6285	0.4265	0.4747	0.7580	0.9577	0.9939	0.9983	(89)
MIT 2	18.1729	18.4555	18.8552	19.3402	19.7161	19.9080	19.9434	19.9419	19.8436	19.3541	18.6698	18.1296	(90)
Living area fraction	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(91)
MIT	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	697.5154	851.2606	964.0869	1020.7284	957.5224	721.8959	483.1924	506.3678	731.9584	793.3958	701.4866	651.0395	(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	2013.5824	1961.6782	1783.9719	1492.7091	1147.9329	760.7763	488.4025	514.9281	824.1293	1253.2532	1659.4091	2003.8822	(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	979.1539	746.2006	609.9945	339.8261	141.6654	0.0000	0.0000	0.0000	0.0000	342.1339	689.7042	1006.5150	(98)
Space heating												4855.1934	(98)
Space heating per m2												40.7588	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5198.2799 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	979.1539	746.2006	609.9945	339.8261	141.6654	0.0000	0.0000	0.0000	0.0000	342.1339	689.7042	1006.5150	(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)	1048.3446	798.9300	653.0990	363.8395	151.6760	0.0000	0.0000	0.0000	0.0000	366.3104	738.4413	1077.6392	(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	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899	(64)
Efficiency of water heater (217)m	88.3792	88.1340	87.6641	86.6220	84.5291	80.3000	80.3000	80.3000	80.3000	86.5519	87.9342	80.3000	(216)
Fuel for water heating, kWh/month	246.1510	217.5390	229.6341	208.2519	206.6612	191.6017	183.5691	204.6365	206.8480	216.1238	225.0309	239.9787	(219)
Water heating fuel used												2576.0259	(219)
Annual totals kWh/year													
Space heating fuel - main system												5198.2799	(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)												450.2204	(232)
Total delivered energy for all uses												8299.5262	(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	5198.2799	0.2160	1122.8285 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.0259	0.2160	556.4216 (264)
Space and water heating			1679.2501 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/m2/year			1951.8394 (272)
Emissions per m2 for space and water heating			14.0971 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9616 (272b)
Emissions per m2 for pumps and fans			0.3268 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0971 * 1.00) + 1.9616 + 0.3268, rounded to 2 d.p.			16.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (2B)			Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (B/2B)	Prop Type Ref	TYPE B / 2 BED / 2 STOREY		
Property	TYPE B / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	86 B	DER	14.28	TER	16.39
Environmental	88 B	% DER<TER	12.85		
CO ₂ Emissions (t/year)	1.42	DFEE	41.68	TFEE	52.69
General Requirements Compliance	Pass	% DFEE<TFEE	20.90		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 119 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.39 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.28 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.7 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 6.30 m², No overhang
Windows facing East: 5.06 m², No overhang
Windows facing South: 12.55 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 285.8880 (5)
Dwelling volume			

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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1399 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3899 (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) =	0.3314 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894 (22b)
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758 (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					
WINDOW (Uw = 1.30)			23.9100	1.2357	29.5466		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			64.4200	0.1100	7.0862		(28a)					
External Wall 1	156.7400	25.9700	130.7700	0.2000	26.1540		(29a)					
External Roof 1	64.4200		64.4200	0.1000	6.4420		(30)					
Total net area of external elements Aum(A, m2)			285.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.2888		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							9.9953 (36)					
Total fabric heat loss						(33) + (36) =	81.2841 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.5947	Feb 55.2677	Mar 54.9470	Apr 53.4412	May 53.1594	Jun 51.8478	Jul 51.8478	Aug 51.6050	Sep 52.3530	Oct 53.1594	Nov 53.7294	Dec 54.3253 (38)
Heat transfer coeff	136.8788	136.5517	136.2311	134.7252	134.4435	133.1319	133.1319	132.8890	133.6371	134.4435	135.0135	135.6093 (39)
Average = Sum(39)m / 12 =												134.7239 (39)
HLP	Jan 1.1491	Feb 1.1463	Mar 1.1436	Apr 1.1310	May 1.1286	Jun 1.1176	Jul 1.1176	Aug 1.1156	Sep 1.1219	Oct 1.1286	Nov 1.1334	Dec 1.1384 (40)
HLP (average)												1.1310 (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												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3336	108.2487	104.1639	100.0790	95.9941	91.9093	91.9093	95.9941	100.0790	104.1639	108.2487	112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)												Total = Sum(45)m = 1606.7676 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	14.7167	13.2782	14.6680	14.1515	14.5791	14.0576	14.4942	14.5493	14.1087	14.6252	14.2040	14.7009 (61)
Solar input	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (64)
	59.0695	51.7643	53.6576	47.1209	45.4637	39.6010	37.0631	42.0097	42.3578	48.9097	52.9486	57.3178 (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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	79.3945	77.0302	72.1204	65.4457	61.1072	55.0013	49.8160	56.4646	58.8303	65.7388	73.5397	77.0400	(72)
Total internal gains	457.8487	455.5817	439.0154	412.0536	384.2335	357.7433	340.7329	347.2842	361.3064	388.5019	419.7845	443.6691	(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					6.3000	10.6334	0.4500	0.0000			0.7700			23.2122 (74)
East					5.0600	19.6403	0.4500	0.0000			0.7700			34.4351 (76)
South					12.5500	46.7521	0.4500	0.0000			0.7700			203.3049 (78)
Solar gains	260.9521	444.6829	610.4472	762.2325	860.9105	858.3087	825.9577	751.4677	662.7092	491.8651	312.5573	223.3427	(83)	
Total gains	718.8008	900.2646	1049.4626	1174.2862	1245.1440	1216.0520	1166.6905	1098.7519	1024.0155	880.3670	732.3417	667.0118	(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	60.4346	60.5794	60.7220	61.4007	61.5294	62.1355	62.1355	62.2491	61.9006	61.5294	61.2696	61.0004	
alpha	5.0290	5.0386	5.0481	5.0934	5.1020	5.1424	5.1424	5.1499	5.1267	5.1020	5.0846	5.0667	
util living area	0.9980	0.9934	0.9803	0.9392	0.8378	0.6627	0.4947	0.5440	0.7900	0.9628	0.9949	0.9986	(86)
MIT	19.7631	19.9711	20.2529	20.5828	20.8361	20.9634	20.9932	20.9892	20.9103	20.5642	20.0921	19.7263	(87)
Th 2	19.9609	19.9632	19.9653	19.9756	19.9775	19.9865	19.9865	19.9881	19.9830	19.9775	19.9736	19.9696	(88)
util rest of house	0.9973	0.9912	0.9736	0.9181	0.7858	0.5730	0.3846	0.4306	0.7104	0.9456	0.9928	0.9981	(89)
MIT 2	18.3131	18.6175	19.0258	19.4958	19.8217	19.9629	19.9840	19.9838	19.9148	19.4811	18.8026	18.2653	(90)
Living area fraction	18.5573	18.8454	19.2325	19.6789	19.9926	20.1314	20.1540	20.1531	20.0825	19.6635	19.0198	18.5114	(91)
MIT	18.4073	18.6954	19.0825	19.5289	19.8426	19.9814	20.0040	20.0031	19.9325	19.5135	18.8698	18.3614	(92)
Temperature adjustment													
adjusted MIT	18.4073	18.6954	19.0825	19.5289	19.8426	19.9814	20.0040	20.0031	19.9325	19.5135	18.8698	18.3614	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	715.6585	888.7438	1013.4189	1064.6204	968.7145	696.2800	451.0304	475.0466	722.8629	823.2191	724.5846	664.9578	(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	1930.9841	1883.7910	1714.1228	1431.9745	1094.7148	716.4387	453.1789	478.8182	779.4364	1198.3587	1589.0760	1920.4119	(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	904.2022	668.6717	521.3237	264.4950	93.7442	0.0000	0.0000	0.0000	0.0000	279.1038	622.4338	934.0579	(98)
Space heating												4288.0323	(98)
Space heating per m2												35.9976	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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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 %)												92.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4615.7506 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	904.2022	668.6717	521.3237	264.4950	93.7442	0.0000	0.0000	0.0000	0.0000	279.1038	622.4338	934.0579 (98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000 (210)
Space heating fuel (main heating system)	973.3070	719.7758	561.1665	284.7094	100.9087	0.0000	0.0000	0.0000	0.0000	300.4347	670.0040	1005.4445 (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	181.3041	158.9766	165.0157	145.2283	140.3504	122.5886	115.0642	129.9548	130.8925	150.7255	162.7681	176.0319 (64)
Efficiency of water heater (217)m	89.9493	89.8673	89.7094	89.3393	88.5539	87.3000	87.3000	87.3000	87.3000	89.3515	89.8175	87.3000 (216)
Fuel for water heating, kWh/month	201.5625	176.9016	183.9447	162.5583	158.4915	140.4223	131.8032	148.8600	149.9341	168.6883	181.2209	195.6410 (219)
Water heating fuel used												2000.0284 (219)
Annual totals kWh/year												
Space heating fuel - main system												4615.7506 (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)												450.2204 (232)
Total delivered energy for all uses												7140.9994 (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	4615.7506	0.2160	997.0021 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2000.0284	0.2160	432.0061 (264)
Space and water heating			1429.0083 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/year			1701.5976 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2800 (273)

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

DER			14.2800 ZC1
Total Floor Area	TFA	119.1200	
Assumed number of occupants	N	2.8598	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.1311	ZC2
CO2 emissions from cooking, equation (L16)		1.5752	ZC3
Total CO2 emissions		29.9863	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		29.9863	ZC8

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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	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 285.8880 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1399 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3899 (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) =							0.3314 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894	(22b)				
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			23.9100	1.3258	31.6989		(27)					
Heat Loss Floor 1			64.4200	0.1300	8.3746		(28a)					
External Wall 1	156.7400	25.9700	130.7700	0.1800	23.5386		(29a)					
External Roof 1	64.4200		64.4200	0.1300	8.3746		(30)					
Total net area of external elements Aum(A, m2)			285.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		74.0467		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8864 (36)					
Total fabric heat loss						(33) + (36) =	86.9331 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.5947	Feb 55.2677	Mar 54.9470	Apr 53.4412	May 53.1594	Jun 51.8478	Jul 51.8478	Aug 51.6050	Sep 52.3530	Oct 53.1594	Nov 53.7294	Dec 54.3253 (38)
Heat transfer coeff	142.5278	142.2007	141.8801	140.3742	140.0925	138.7809	138.7809	138.5380	139.2861	140.0925	140.6624	141.2583 (39)
Average = Sum(39)m / 12 =												140.3729 (39)
HLP	Jan 1.1965	Feb 1.1938	Mar 1.1911	Apr 1.1784	May 1.1761	Jun 1.1651	Jul 1.1651	Aug 1.1630	Sep 1.1693	Oct 1.1761	Nov 1.1808	Dec 1.1858 (40)
HLP (average)												1.1784 (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												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
Daily hot water use	Jan 112.3336	Feb 108.2487	Mar 104.1639	Apr 100.0790	May 95.9941	Jun 91.9093	Jul 91.9093	Aug 95.9941	Sep 100.0790	Oct 104.1639	Nov 108.2487	Dec 112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)												Total = Sum(45)m = 1606.7676 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (46)
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												

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi 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)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	48.9176	45.3251	46.8360	48.9176	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899 (64)
	68.1300	59.9516	62.7303	55.9118	54.0483	47.4179	45.1485	50.6017	51.1594	57.9931	61.7263	66.3823 (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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	91.5726	89.2137	84.3150	77.6553	72.6456	65.8581	60.6835	68.0131	71.0547	77.9477	85.7310	89.2235	(72)
Total internal gains	470.0268	467.7651	451.2099	424.2632	395.7719	368.6001	351.6004	358.8327	373.5308	400.7108	431.9758	455.8526	(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				6.3000	10.6334	0.6300	0.7000	0.7700	20.4731 (74)			
East				5.0600	19.6403	0.6300	0.7000	0.7700	30.3717 (76)			
South				12.5500	46.7521	0.6300	0.7000	0.7700	179.3149 (78)			
Solar gains	230.1598	392.2103	538.4144	672.2891	759.3231	757.0283	728.4947	662.7945	584.5095	433.8250	275.6755	196.9882 (83)
Total gains	700.1866	859.9755	989.6244	1096.5523	1155.0950	1125.6284	1080.0951	1021.6272	958.0403	834.5358	707.6513	652.8408 (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	58.0394	58.1729	58.3043	58.9298	59.0483	59.6063	59.6063	59.7108	59.3901	59.0483	58.8090	58.5610	
alpha	4.8693	4.8782	4.8870	4.9287	4.9366	4.9738	4.9738	4.9807	4.9593	4.9366	4.9206	4.9041	
util living area	0.9982	0.9947	0.9853	0.9557	0.8774	0.7214	0.5505	0.6000	0.8335	0.9717	0.9957	0.9987	(86)
MIT	19.6856	19.8784	20.1531	20.4897	20.7729	20.9401	20.9873	20.9809	20.8723	20.4930	20.0195	19.6518	(87)
Th 2	19.9228	19.9250	19.9272	19.9373	19.9392	19.9481	19.9481	19.9497	19.9446	19.9392	19.9354	19.9313	(88)
util rest of house	0.9975	0.9929	0.9800	0.9389	0.8312	0.6285	0.4265	0.4747	0.7580	0.9577	0.9939	0.9983	(89)
MIT 2	18.1729	18.4555	18.8552	19.3402	19.7161	19.9080	19.9434	19.9419	19.8436	19.3541	18.6698	18.1296	(90)
Living area fraction	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(91)
MIT	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4276	18.6951	19.0738	19.5338	19.8941	20.0819	20.1192	20.1169	20.0168	19.5459	18.8971	18.3859	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	697.5154	851.2606	964.0869	1020.7284	957.5224	721.8959	483.1924	506.3678	731.9584	793.3958	701.4866	651.0395	(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	2013.5824	1961.6782	1783.9719	1492.7091	1147.9329	760.7763	488.4025	514.9281	824.1293	1253.2532	1659.4091	2003.8822	(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	979.1539	746.2006	609.9945	339.8261	141.6654	0.0000	0.0000	0.0000	0.0000	342.1339	689.7042	1006.5150	(98)
Space heating												4855.1934	(98)
Space heating per m2												40.7588	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5198.2799 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	979.1539	746.2006	609.9945	339.8261	141.6654	0.0000	0.0000	0.0000	0.0000	342.1339	689.7042	1006.5150	(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)	1048.3446	798.9300	653.0990	363.8395	151.6760	0.0000	0.0000	0.0000	0.0000	366.3104	738.4413	1077.6392	(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	217.5463	191.7258	201.3066	180.3919	174.6889	153.8562	147.4060	164.3231	166.0989	187.0592	197.8792	212.2899	(64)
Efficiency of water heater (217)m	88.3792	88.1340	87.6641	86.6220	84.5291	80.3000	80.3000	80.3000	80.3000	86.5519	87.9342	80.3000	(216)
Fuel for water heating, kWh/month	246.1510	217.5390	229.6341	208.2519	206.6612	191.6017	183.5691	204.6365	206.8480	216.1238	225.0309	239.9787	(219)
Water heating fuel used												2576.0259	(219)
Annual totals kWh/year													
Space heating fuel - main system												5198.2799	(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)												450.2204	(232)
Total delivered energy for all uses												8299.5262	(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	5198.2799	0.2160	1122.8285 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2576.0259	0.2160	556.4216 (264)
Space and water heating			1679.2501 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/m2/year			1951.8394 (272)
Emissions per m2 for space and water heating			14.0971 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9616 (272b)
Emissions per m2 for pumps and fans			0.3268 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0971 * 1.00) + 1.9616 + 0.3268, rounded to 2 d.p.			16.3900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (2B)			Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (B/2B)	Prop Type Ref	TYPE B / 2 BED / 2 STOREY		
Property	TYPE B / 2 BED / 2 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	90 B	DER	10.05	TER	23.68
Environmental	91 B	% DER<TER	57.56		
CO ₂ Emissions (t/year)	1.04	DFEE	41.68	TFEE	52.69
General Requirements Compliance	Pass	% DFEE<TFEE	20.90		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 119 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.68 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 10.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)41.7 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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.11 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

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

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley):	Not significant	OK
Based on:		
Overshading:	Average	
Windows facing North:	6.30 m ² , No overhang	
Windows facing East:	5.06 m ² , No overhang	
Windows facing South:	12.55 m ² , No overhang	
Air change rate:	8.00 ach	
Blinds/curtains:	None	

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K

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	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 285.8880 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.1399 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3899 (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) =					0.3314 (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	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894	(22b)				
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(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					
WINDOW (Uw = 1.30)			23.9100	1.2357	29.5466		(27)					
DOOR			2.0600	1.0000	2.0600		(26)					
Heat Loss Floor 1			64.4200	0.1100	7.0862		(28a)					
External Wall 1	156.7400	25.9700	130.7700	0.2000	26.1540		(29a)					
External Roof 1	64.4200		64.4200	0.1000	6.4420		(30)					
Total net area of external elements Aum(A, m2)			285.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.2888		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)							9.9953 (36)					
Total fabric heat loss						(33) + (36) =	81.2841 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.5947	Feb 55.2677	Mar 54.9470	Apr 53.4412	May 53.1594	Jun 51.8478	Jul 51.8478	Aug 51.6050	Sep 52.3530	Oct 53.1594	Nov 53.7294	Dec 54.3253 (38)
Heat transfer coeff	136.8788	136.5517	136.2311	134.7252	134.4435	133.1319	133.1319	132.8890	133.6371	134.4435	135.0135	135.6093 (39)
Average = Sum(39)m / 12 =												134.7239 (39)
HLP	Jan 1.1491	Feb 1.1463	Mar 1.1436	Apr 1.1310	May 1.1286	Jun 1.1176	Jul 1.1176	Aug 1.1156	Sep 1.1219	Oct 1.1286	Nov 1.1334	Dec 1.1384 (40)
HLP (average)												1.1310 (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												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
Daily hot water use	Jan 112.3336	Feb 108.2487	Mar 104.1639	Apr 100.0790	May 95.9941	Jun 91.9093	Jul 91.9093	Aug 95.9941	Sep 100.0790	Oct 104.1639	Nov 108.2487	Dec 112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)										Total = Sum(45)m =		1606.7676 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Enter (49) or (54) in (55)													0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	208.4312	183.4928	192.1915	171.5708	167.6151	149.0251	142.4138	157.2493	157.2778	177.9441	189.0581	203.1748	(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	208.4312	183.4928	192.1915	171.5708	167.6151	149.0251	142.4138	157.2493	157.2778	177.9441	189.0581	203.1748	(64)
Heat gains from water heating, kWh/month	88.8654	78.6802	83.4657	75.9782	75.2940	68.4818	66.9146	71.8474	71.2258	78.7284	81.7928	87.1176	(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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	119.4427	117.0837	112.1850	105.5253	101.2016	95.1136	89.9389	96.5691	98.9248	105.8177	113.6011	117.0936	(72)
Total internal gains	494.8969	492.6352	476.0800	449.1332	421.3279	394.8556	377.8558	384.3886	398.4009	425.5809	456.8458	480.7227	(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				6.3000	10.6334	0.4500	0.0000	0.7700	23.2122 (74)			
East				5.0600	19.6403	0.4500	0.0000	0.7700	34.4351 (76)			
South				12.5500	46.7521	0.4500	0.0000	0.7700	203.3049 (78)			
Solar gains	260.9521	444.6829	610.4472	762.2325	860.9105	858.3087	825.9577	751.4677	662.7092	491.8651	312.5573	223.3427 (83)
Total gains	755.8490	937.3181	1086.5272	1211.3658	1282.2384	1253.1643	1203.8135	1135.8564	1061.1100	917.4460	769.4031	704.0653 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.4346	60.5794	60.7220	61.4007	61.5294	62.1355	62.1355	62.2491	61.9006	61.5294	61.2696	61.0004	
alpha	5.0290	5.0386	5.0481	5.0934	5.1020	5.1424	5.1424	5.1499	5.1267	5.1020	5.0846	5.0667	
util living area	0.9974	0.9921	0.9774	0.9323	0.8254	0.6469	0.4804	0.5277	0.7729	0.9566	0.9936	0.9982	(86)
Tweekday	18.3551	18.6581	19.0627	19.5232	19.8346	19.9656	19.9844	19.9844	19.9226	19.5127	18.8437	18.3077	
Tweekend	20.2191	20.3530	20.5339	20.7439	20.9018	20.9788	20.9962	20.9939	20.9478	20.7336	20.4314	20.1953	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7947	19.9992	20.2807	20.6000	20.8484	20.9674	20.9941	20.9906	20.9185	20.5889	20.1122	19.7581	(87)
Th 2	19.9609	19.9632	19.9653	19.9756	19.9775	19.9865	19.9865	19.9881	19.9830	19.9775	19.9736	19.9696	(88)
util rest of house	0.9966	0.9895	0.9697	0.9095	0.7717	0.5579	0.3730	0.4170	0.6918	0.9372	0.9911	0.9976	(89)
Tweekday	18.3551	18.6581	19.0627	19.5232	19.8346	19.9656	19.9844	19.9844	19.9226	19.5127	18.8437	18.3077	
Tweekend	18.3551	18.6581	19.0627	19.5232	19.8346	19.9656	19.9844	19.9844	19.9226	19.5127	18.8437	18.3077	
MIT 2	18.3551	18.6581	19.0627	19.5232	19.8346	19.9656	19.9844	19.9844	19.9226	19.5127	18.8437	18.3077	(90)
Living area fraction	fLA = Living area / (4) =												0.1684 (91)
MIT	18.5976	18.8840	19.2678	19.7046	20.0053	20.1343	20.1544	20.1539	20.0903	19.6940	19.0573	18.5519	(92)
Temperature adjustment													0.0000
adjusted MIT	18.5976	18.8840	19.2678	19.7046	20.0053	20.1343	20.1544	20.1539	20.0903	19.6940	19.0573	18.5519	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9949	0.9857	0.9629	0.9022	0.7734	0.5715	0.3911	0.4356	0.7013	0.9302	0.9878	0.9963	(94)
Ext temp.	751.9579	923.9049	1046.2698	1092.9499	991.6524	716.2282	470.8360	494.7814	744.1337	853.4340	759.9999	701.4584	(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	1957.0323	1909.5352	1739.3771	1455.6466	1116.5957	736.7921	473.2035	498.8476	800.5236	1222.6229	1614.3975	1946.2583	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	896.5753	662.3436	515.6718	261.1416	92.9578	0.0000	0.0000	0.0000	0.0000	274.6765	615.1663	926.1311	(98)
Space heating per m2	(98) / (4) =												35.6335 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													383.2061	(206)
Efficiency of secondary/supplementary heating system, %													100.0000	(208)
Space heating requirement													1107.6712	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	896.5753	662.3436	515.6718	261.1416	92.9578	0.0000	0.0000	0.0000	0.0000	274.6765	615.1663	926.1311	(98)	
Space heating efficiency (main heating system 1)	383.2061	383.2061	383.2061	383.2061	383.2061	0.0000	0.0000	0.0000	0.0000	383.2061	383.2061	383.2061	(210)	
Space heating fuel (main heating system)	233.9668	172.8426	134.5677	68.1465	24.2579	0.0000	0.0000	0.0000	0.0000	71.6785	160.5314	241.6796	(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	208.4312	183.4928	192.1915	171.5708	167.6151	149.0251	142.4138	157.2493	157.2778	177.9441	189.0581	203.1748	(64)	
Efficiency of water heater (217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)	
Fuel for water heating, kWh/month	74.4490	65.5413	68.6484	61.2829	59.8700	53.2299	50.8684	56.1675	56.1777	63.5594	67.5292	72.5715	(219)	
Water heating fuel used												749.8954	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1107.6712	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
Total electricity for the above, kWh/year												0.0000	(231)	
Electricity for lighting (calculated in Appendix L)												450.2204	(232)	
Total delivered energy for all uses												2307.7870	(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	1107.6712	0.5190	574.8814 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	749.8954	0.5190	389.1957 (264)
Space and water heating			964.0771 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/year			1197.7415 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			10.0500 (273)

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

DER		10.0500	ZC1
Total Floor Area	TFA	119.1200	
Assumed number of occupants	N	2.8598	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.1311	ZC2
CO2 emissions from cooking, equation (L16)		1.5752	ZC3
Total CO2 emissions		25.7563	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		25.7563	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	64.4200 (1b)	x 2.4000 (2b)	= 154.6080 (1b) - (3b)
First floor	54.7000 (1c)	x 2.4000 (2c)	= 131.2800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 285.8880 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.1399 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3899 (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) =							0.3314 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4226	0.4143	0.4060	0.3646	0.3563	0.3149	0.3149	0.3066	0.3314	0.3563	0.3729	0.3894	(22b)				
Effective ac	0.5893	0.5858	0.5824	0.5665	0.5635	0.5496	0.5496	0.5470	0.5549	0.5635	0.5695	0.5758	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			23.9100	1.3258	31.6989		(27)					
Heat Loss Floor 1			64.4200	0.1300	8.3746		(28a)					
External Wall 1	156.7400	25.9700	130.7700	0.1800	23.5386		(29a)					
External Roof 1	64.4200		64.4200	0.1300	8.3746		(30)					
Total net area of external elements Aum(A, m2)			285.5800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.0467		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.8864 (36)					
Total fabric heat loss						(33) + (36) =	86.9331 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.5947	Feb 55.2677	Mar 54.9470	Apr 53.4412	May 53.1594	Jun 51.8478	Jul 51.8478	Aug 51.6050	Sep 52.3530	Oct 53.1594	Nov 53.7294	Dec 54.3253 (38)
Heat transfer coeff	142.5278	142.2007	141.8801	140.3742	140.0925	138.7809	138.7809	138.5380	139.2861	140.0925	140.6624	141.2583 (39)
Average = Sum(39)m / 12 =												140.3729 (39)
HLP	Jan 1.1965	Feb 1.1938	Mar 1.1911	Apr 1.1784	May 1.1761	Jun 1.1651	Jul 1.1651	Aug 1.1630	Sep 1.1693	Oct 1.1761	Nov 1.1808	Dec 1.1858 (40)
HLP (average)												1.1784 (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												2.8598 (42)
Average daily hot water use (litres/day)												102.1214 (43)
Daily hot water use	Jan 112.3336	Feb 108.2487	Mar 104.1639	Apr 100.0790	May 95.9941	Jun 91.9093	Jul 91.9093	Aug 95.9941	Sep 100.0790	Oct 104.1639	Nov 108.2487	Dec 112.3336 (44)
Energy conte	166.5874	145.6984	150.3477	131.0768	125.7713	108.5311	100.5700	115.4055	116.7838	136.1003	148.5641	161.3310 (45)
Energy content (annual)										Total = Sum(45)m =		1606.7676 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9881	21.8548	22.5522	19.6615	18.8657	16.2797	15.0855	17.3108	17.5176	20.4150	22.2846	24.1997 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)
Temperature factor from Table 2b												0.5400 (49)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (56)
If cylinder contains dedicated solar storage	25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	215.8301	190.1757	199.5904	178.7310	175.0140	156.1853	149.8127	164.6482	164.4380	185.3430	196.2183	210.5737 (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	215.8301	190.1757	199.5904	178.7310	175.0140	156.1853	149.8127	164.6482	164.4380	185.3430	196.2183	210.5737 (64)
Heat gains from water heating, kWh/month	94.7845	84.0265	89.3848	81.7064	81.2131	74.2099	72.8337	77.7665	76.9540	84.6475	87.5209	93.0367 (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	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	142.9925	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.4933	22.6430	18.4145	13.9410	10.4210	8.7979	9.5064	12.3568	16.5853	21.0588	24.5787	26.2019	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	284.0631	287.0108	279.5827	263.7692	243.8075	225.0464	212.5127	209.5651	216.9931	232.8066	252.7683	271.5295	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	37.2992	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	-114.3940	(71)
Water heating gains (Table 5)	127.3985	125.0395	120.1408	113.4811	109.1574	103.0694	97.8947	104.5248	106.8805	113.7735	121.5569	125.0493	(72)
Total internal gains	505.8526	503.5910	487.0357	460.0890	432.2837	405.8113	388.8116	395.3444	409.3567	436.5367	467.8016	491.6784	(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					6.3000	10.6334		0.6300	0.7000	0.7700		20.4731 (74)	
East					5.0600	19.6403		0.6300	0.7000	0.7700		30.3717 (76)	
South					12.5500	46.7521		0.6300	0.7000	0.7700		179.3149 (78)	

Solar gains	230.1598	392.2103	538.4144	672.2891	759.3231	757.0283	728.4947	662.7945	584.5095	433.8250	275.6755	196.9882	(83)
Total gains	736.0124	895.8013	1025.4502	1132.3781	1191.6067	1162.8396	1117.3063	1058.1390	993.8661	870.3616	743.4771	688.6667	(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	58.0394	58.1729	58.3043	58.9298	59.0483	59.6063	59.6063	59.7108	59.3901	59.0483	58.8090	58.5610
alpha	4.8693	4.8782	4.8870	4.9287	4.9366	4.9738	4.9738	4.9807	4.9593	4.9366	4.9206	4.9041
util living area	0.9977	0.9937	0.9830	0.9503	0.8664	0.7048	0.5339	0.5821	0.8179	0.9668	0.9947	0.9984 (86)
MIT	19.7133	19.9055	20.1789	20.5118	20.7878	20.9460	20.9889	20.9832	20.8836	20.5170	20.0469	19.6797 (87)
Th 2	19.9228	19.9250	19.9272	19.9373	19.9392	19.9481	19.9481	19.9497	19.9446	19.9392	19.9354	19.9313 (88)
util rest of house	0.9969	0.9916	0.9770	0.9320	0.8180	0.6117	0.4128	0.4592	0.7399	0.9509	0.9925	0.9978 (89)
MIT 2	18.2133	18.4949	18.8920	19.3698	19.7329	19.9125	19.9441	19.9430	19.8541	19.3867	18.7095	18.1703 (90)
Living area fraction									fLA = Living area / (4) =			0.1684 (91)
MIT	18.4659	18.7325	19.1087	19.5621	19.9106	20.0865	20.1200	20.1181	20.0275	19.5770	18.9347	18.4244 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4659	18.7325	19.1087	19.5621	19.9106	20.0865	20.1200	20.1181	20.0275	19.5770	18.9347	18.4244 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9953	0.9881	0.9708	0.9239	0.8165	0.6249	0.4332	0.4798	0.7469	0.9436	0.9894	0.9965	(94)
Ext temp.	732.5679	885.1790	995.4740	1046.1780	972.9813	726.6617	483.9898	507.6768	742.3261	821.2857	735.6168	686.2901	(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	2019.0372	1966.9866	1788.9233	1496.6894	1150.2390	761.4263	488.5111	515.1048	825.6117	1257.6146	1664.6974	2009.3206	(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	957.1332	726.9747	590.3263	324.3682	131.8797	0.0000	0.0000	0.0000	0.0000	324.6287	668.9380	984.3347	(98)
Space heating per m2												4708.5835	(98)
												(98) / (4) =	39.5281 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5035.9182 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	957.1332	726.9747	590.3263	324.3682	131.8797	0.0000	0.0000	0.0000	0.0000	324.6287	668.9380	984.3347 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	1023.6719	777.5131	631.3650	346.9178	141.0478	0.0000	0.0000	0.0000	0.0000	347.1965	715.4417	1052.7643 (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	215.8301	190.1757	199.5904	178.7310	175.0140	156.1853	149.8127	164.6482	164.4380	185.3430	196.2183	210.5737 (64)
Efficiency of water heater (217)m	88.3209	88.0519	87.5344	86.3850	84.0714	79.8000	79.8000	79.8000	79.8000	86.2947	87.8291	79.8000 (216)
Fuel for water heating, kWh/month	244.3703	215.9814	228.0138	206.9004	208.1729	195.7209	187.7352	206.3261	206.0627	214.7791	223.4093	88.4109 (217)
Water heating fuel used												238.1761 (219)
Annual totals kWh/year												2575.6482 (219)
Space heating fuel - main system												5035.9182 (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)												450.2204 (232)
Total delivered energy for all uses												8136.7868 (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	5035.9182	0.2160	1087.7583 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2575.6482	0.2160	556.3400 (264)
Space and water heating			1644.0983 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	450.2204	0.5190	233.6644 (268)
Total CO2, kg/m2/year			1916.6877 (272)
Emissions per m2 for space and water heating			13.8020 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.9616 (272b)
Emissions per m2 for pumps and fans			0.3268 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8020 * 1.55) + 1.9616 + 0.3268, rounded to 2 d.p.			23.6800 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (3B)				Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (B/3B)	Prop Type Ref	TYPE B / 3 BED / 3 STOREY			
Property	TYPE B / 3 BED / 3 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating		86 B	DER	14.23	TER	16.22
Environmental		87 B	% DER<TER	12.25		
CO ₂ Emissions (t/year)		1.82	DFEE	44.33	TFEE	58.08
General Requirements Compliance		Pass	% DFEE<TFEE	23.67		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

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

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

DWELLING AS DESIGNED

Detached House, total floor area 152 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.23 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.3 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 16.67 m², No overhang
Windows facing East: 4.67 m², No overhang
Windows facing South: 12.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging ψ -value 0.035 W/m²K

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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	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					5 * 10 = 50.0000 (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 50.0000 / (5) = 0.1367 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3867 (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) =		0.3287 (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	0.4190	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3697	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5810	0.5654	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746 (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
WINDOW (Uw = 1.30)			33.3900	1.2357	41.2614		(27)
DOOR			2.2500	1.0000	2.2500		(26)
Heat Loss Floor 1			64.1100	0.1100	7.0521		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.2000	35.4820		(29a)
External Roof 1	64.1100		64.1100	0.1000	6.4110		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		92.4565		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							11.9445 (36)
Total fabric heat loss						(33) + (36) =	104.4010 (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	70.9667	70.5551	70.1516	68.2565	67.9019	66.2513	66.2513	65.9456	66.8871	67.9019	68.6192	69.3691 (38)
Heat transfer coeff	175.3676	174.9560	174.5525	172.6574	172.3028	170.6523	170.6523	170.3466	171.2880	172.3028	173.0201	173.7700 (39)
Average = Sum(39)m / 12 =												172.6557 (39)
HLP	1.1504	1.1477	1.1451	1.1326	1.1303	1.1195	1.1195	1.1175	1.1236	1.1303	1.1350	1.1399 (40)
HLP (average)												1.1326 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy content (annual)	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.7257	13.2861	14.6761	14.1587	14.5924	14.0685	14.5044	14.5614	14.1150	14.6326	14.2121	14.7097 (61)
Total heat required for water heating calculated for each month	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704 (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	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704 (64)
Heat gains from water heating, kWh/month	60.0776	52.6460	54.5675	47.9141	46.2265	40.2590	37.6729	42.7095	43.0645	49.7333	53.8476	58.2941 (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	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897 (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)	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173 (71)
Water heating gains (Table 5)	80.7495	78.3422	73.3434	66.5474	62.1323	55.9153	50.6356	57.4053	59.8118	66.8458	74.7884	78.3523 (72)
Total internal gains	502.8072	500.5305	482.3001	452.4559	421.3515	391.9556	373.2181	379.8572	395.4953	425.5776	460.2094	486.9522 (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					16.6700	10.6334	0.4500	0.0000	0.7700		61.4201 (74)	
East					4.6700	19.6403	0.4500	0.0000	0.7700		31.7810 (76)	
South					12.0500	46.7521	0.4500	0.0000	0.7700		195.2051 (78)	

Solar gains	288.4062	499.2430	709.0734	929.9594	1094.1952	1110.9156	1060.6786	933.3850	784.2906	558.3141	346.7814	246.0131 (83)
Total gains	791.2133	999.7735	1191.3735	1382.4152	1515.5467	1502.8712	1433.8967	1313.2422	1179.7859	983.8916	806.9908	732.9654 (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	60.3652	60.5073	60.6471	61.3128	61.4390	62.0332	62.0332	62.1445	61.8030	61.4390	61.1843	60.9202
alpha	5.0243	5.0338	5.0431	5.0875	5.0959	5.1355	5.1355	5.1430	5.1202	5.0959	5.0790	5.0613
util living area	0.9990	0.9965	0.9880	0.9550	0.8583	0.6818	0.5145	0.5790	0.8374	0.9782	0.9974	0.9993 (86)
MIT	19.6828	19.8779	20.1651	20.5247	20.8135	20.9582	20.9919	20.9856	20.8799	20.4871	20.0115	19.6502 (87)
Th 2	19.9599	19.9621	19.9642	19.9743	19.9762	19.9850	19.9850	19.9866	19.9816	19.9762	19.9723	19.9684 (88)
util rest of house	0.9986	0.9953	0.9837	0.9382	0.8095	0.5915	0.4006	0.4603	0.7642	0.9672	0.9963	0.9991 (89)
MIT 2	18.1949	18.4815	18.9001	19.4175	19.7958	19.9577	19.9820	19.9807	19.8856	19.3749	18.6846	18.1533 (90)
Living area fraction	18.3836	18.6585	19.0605	19.5579	19.9248	20.0846	20.1101	20.1082	20.0117	19.5159	18.8529	18.3431 (92)
Temperature adjustment	18.2336	18.5085	18.9105	19.4079	19.7748	19.9346	19.9601	19.9582	19.8617	19.3659	18.7029	18.1931 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9977	0.9926	0.9773	0.9262	0.7982	0.5867	0.3977	0.4568	0.7540	0.9577	0.9941	0.9984 (94)
Ext temp.	789.3584	992.3812	1164.3568	1280.3842	1209.7775	881.6878	570.2841	599.9485	889.5852	942.2277	802.2585	731.7807 (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	2443.5003	2380.8944	2166.2792	1814.2740	1391.3170	910.3597	573.4031	606.1224	986.9114	1510.3940	2007.5355	2431.5864 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1230.6816	933.0809	745.4303	384.4007	135.0654	0.0000	0.0000	0.0000	0.0000	422.7157	867.7995	1264.6555 (98)
												5983.8294 (98)
												39.2537 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

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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													6611.9662	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1230.6816	933.0809	745.4303	384.4007	135.0654	0.0000	0.0000	0.0000	0.0000	422.7157	867.7995	1264.6555	(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)	1359.8692	1031.0286	823.6799	424.7521	149.2435	0.0000	0.0000	0.0000	0.0000	467.0892	958.8944	1397.4094	(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	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704	(64)	
Efficiency of water heater (217)m	90.0699	90.0128	89.8947	89.5888	88.8276	87.3000	87.3000	87.3000	87.3000	89.6261	89.9719	90.0906	(216)	
Fuel for water heating, kWh/month	204.6614	179.5636	186.6118	164.7703	160.5894	142.6924	133.9068	151.2745	152.3707	170.9374	183.9176	198.6560	(219)	
Water heating fuel used												2029.9519	(219)	
Annual totals kWh/year														
Space heating fuel - main system													6611.9662	(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)													509.0499	(232)
Total delivered energy for all uses													9225.9681	(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	6611.9662	0.2160	1428.1847 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.9519	0.2160	438.4696 (264)
Space and water heating			1866.6543 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	509.0499	0.5190	264.1969 (268)
Total CO2, kg/year			2169.7762 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2300 (273)

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

DER			14.2300	ZC1
Total Floor Area	TFA	152.4400		
Assumed number of occupants	N	2.9379		
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190		
CO2 emissions from appliances, equation (L14)		12.5623	ZC2	
CO2 emissions from cooking, equation (L16)		1.2432	ZC3	
Total CO2 emissions		28.0355	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		28.0355	ZC8	

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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	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					4 * 10 = 40.0000 (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 40.0000 / (5) = 0.1093 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3593 (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) =		0.3054 (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	0.3894	0.3818	0.3742	0.3360	0.3283	0.2902	0.2902	0.2825	0.3054	0.3283	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5466	0.5539	0.5590	0.5644 (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			2.2500	1.0000	2.2500		(26)
TER Opening Type (Uw = 1.40)			33.3900	1.3258	44.2670		(27)
Heat Loss Floor 1			64.1100	0.1300	8.3343		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.1800	31.9338		(29a)
External Roof 1	64.1100		64.1100	0.1300	8.3343		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.1194		(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)							22.3507 (36)
Total fabric heat loss						(33) + (36) =	117.4701 (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	69.5210	69.1655	68.8170	67.1804	66.8742	65.4487	65.4487	65.1847	65.9978	66.8742	67.4936	68.1413 (38)
Heat transfer coeff	186.9911	186.6356	186.2872	184.6505	184.3443	182.9188	182.9188	182.6549	183.4679	184.3443	184.9638	185.6114 (39)
Average = Sum(39)m / 12 =												184.6491 (39)
HLP	1.2267	1.2243	1.2220	1.2113	1.2093	1.1999	1.1999	1.1982	1.2035	1.2093	1.2134	1.2176 (40)
HLP (average)												1.2113 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy content (annual)	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8059	46.1482	47.6865	49.8059	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(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	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(64)
Heat gains from water heating, kWh/month	69.1359	60.8313	63.6381	56.7032	55.0298	48.2789	45.9684	51.5206	51.8645	58.8149	62.6234	67.3564	(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	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	(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)	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	(71)
Water heating gains (Table 5)	92.9246	90.5228	85.5351	78.7545	73.9648	67.0541	61.7855	69.2482	72.0341	79.0522	86.9769	90.5328	(72)
Total internal gains	514.9823	512.7110	494.4919	464.6629	433.1840	403.0944	384.3680	391.7001	407.7176	437.7840	472.3980	499.1327	(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	16.6700	10.6334	0.6300	0.7000	0.7700	54.1725	(74)
East	4.6700	19.6403	0.6300	0.7000	0.7700	28.0308	(76)
South	12.0500	46.7521	0.6300	0.7000	0.7700	172.1709	(78)

Solar gains	254.3742	440.3323	625.4027	820.2242	965.0802	979.8275	935.5185	823.2456	691.7443	492.4330	305.8612	216.9836	(83)
Total gains	769.3565	953.0433	1119.8946	1284.8871	1398.2642	1382.9219	1319.8865	1214.9457	1099.4618	930.2170	778.2591	716.1163	(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	56.6129	56.7207	56.8268	57.3305	57.4258	57.8733	57.8733	57.9569	57.7001	57.4258	57.2334	57.0337	
alpha	4.7742	4.7814	4.7885	4.8220	4.8284	4.8582	4.8582	4.8638	4.8467	4.8284	4.8156	4.8022	
util living area	0.9991	0.9972	0.9913	0.9693	0.9009	0.7537	0.5870	0.6515	0.8817	0.9841	0.9978	0.9993	(86)
MIT	19.5696	19.7512	20.0325	20.3975	20.7228	20.9217	20.9816	20.9703	20.8191	20.3894	19.9071	19.5378	(87)
Th 2	19.8987	19.9006	19.9024	19.9110	19.9126	19.9200	19.9200	19.9214	19.9172	19.9126	19.9093	19.9059	(88)
util rest of house	0.9987	0.9962	0.9880	0.9568	0.8596	0.6603	0.4543	0.5178	0.8164	0.9755	0.9968	0.9991	(89)
MIT 2	17.9868	18.2533	18.6642	19.1936	19.6341	19.8664	19.9132	19.9089	19.7656	19.1901	18.4879	17.9452	(90)
Living area fraction	18.1875	18.4433	18.8377	19.3463	19.7721	20.0003	20.0487	20.0434	19.8992	19.3422	18.6678	18.1471	(92)
Temperature adjustment	18.1875	18.4433	18.8377	19.3463	19.7721	20.0003	20.0487	20.0434	19.8992	19.3422	18.6678	18.1471	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9941	0.9833	0.9481	0.8531	0.6680	0.4709	0.5341	0.8151	0.9690	0.9951	0.9985	(94)
Ext temp.	767.7286	947.4238	1101.2417	1218.1374	1192.9203	923.8577	621.5913	648.8975	896.1466	901.3533	774.4492	715.0338	(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	2596.8388	2527.6548	2298.3562	1928.9110	1488.0496	987.8075	630.8333	665.4925	1063.9591	1611.5782	2139.6311	2588.7448	(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 per m2	1360.8580	1061.9152	890.6532	511.7570	219.5762	0.0000	0.0000	0.0000	0.0000	528.4073	982.9309	1394.0410	(98)
												6950.1389	(98)
												45.5926	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7441.2622	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1360.8580	1061.9152	890.6532	511.7570	219.5762	0.0000	0.0000	0.0000	0.0000	528.4073	982.9309	1394.0410	(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)	1457.0214	1136.9542	953.5902	547.9197	235.0923	0.0000	0.0000	0.0000	0.0000	565.7466	1052.3886	1492.5492	(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	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(64)	
Efficiency of water heater (217)m	88.8414	88.6744	88.3292	87.5036	85.5827	80.3000	80.3000	80.3000	80.3000	87.4948	88.5132	88.9045	(216)	
Fuel for water heating, kWh/month	248.2754	219.1971	230.9958	208.8737	207.8237	195.0811	186.9026	208.3526	209.4890	216.6195	226.6069	242.0795	(219)	
Water heating fuel used												2600.2969	(219)	
Annual totals kWh/year														
Space heating fuel - main system													7441.2622	(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)													509.0499	(232)
Total delivered energy for all uses													10625.6090	(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	7441.2622	0.2160	1607.3126 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2600.2969	0.2160	561.6641 (264)
Space and water heating			2168.9768 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	509.0499	0.5190	264.1969 (268)
Total CO2, kg/m2/year			2472.0987 (272)
Emissions per m2 for space and water heating			14.2284 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7331 (272b)
Emissions per m2 for pumps and fans			0.2553 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2284 * 1.00) + 1.7331 + 0.2553, rounded to 2 d.p.			16.2200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (3B)			Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (B/3B)	Prop Type Ref	TYPE B / 3 BED / 3 STOREY		
Property	TYPE B / 3 BED / 3 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	86 B	DER	13.99	TER	16.22
Environmental	87 B	% DER<TER	13.73		
CO ₂ Emissions (t/year)	1.79	DFEE	44.33	TFEE	58.08
General Requirements Compliance	Pass	% DFEE<TFEE	23.67		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 152 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.22 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.99 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.3 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 16.67 m², No overhang
Windows facing East: 4.67 m², No overhang
Windows facing South: 12.05 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging ψ -value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					5 * 10 = 50.0000 (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) =				50.0000 / (5) = 0.1367 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3867 (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) =				0.3287 (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	0.4190	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3697	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5810	0.5654	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746 (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
WINDOW (Uw = 1.30)			33.3900	1.2357	41.2614		(27)
DOOR			2.2500	1.0000	2.2500		(26)
Heat Loss Floor 1			64.1100	0.1100	7.0521		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.2000	35.4820		(29a)
External Roof 1	64.1100		64.1100	0.1000	6.4110		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	92.4565		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							11.9445 (36)
Total fabric heat loss						(33) + (36) =	104.4010 (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	70.9667	70.5551	70.1516	68.2565	67.9019	66.2513	66.2513	65.9456	66.8871	67.9019	68.6192	69.3691 (38)
Heat transfer coeff	175.3676	174.9560	174.5525	172.6574	172.3028	170.6523	170.6523	170.3466	171.2880	172.3028	173.0201	173.7700 (39)
Average = Sum(39)m / 12 =												172.6557 (39)
HLP	1.1504	1.1477	1.1451	1.1326	1.1303	1.1195	1.1195	1.1175	1.1236	1.1303	1.1350	1.1399 (40)
HLP (average)												1.1326 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy content (annual)	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.7257	13.2861	14.6761	14.1587	14.5924	14.0685	14.5044	14.5614	14.1150	14.6326	14.2121	14.7097 (61)
Total heat required for water heating calculated for each month	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704 (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	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704 (64)
Heat gains from water heating, kWh/month	60.0776	52.6460	54.5675	47.9141	46.2265	40.2590	37.6729	42.7095	43.0645	49.7333	53.8476	58.2941 (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	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897 (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)	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173 (71)
Water heating gains (Table 5)	80.7495	78.3422	73.3434	66.5474	62.1323	55.9153	50.6356	57.4053	59.8118	66.8458	74.7884	78.3523 (72)
Total internal gains	502.8072	500.5305	482.3001	452.4559	421.3515	391.9556	373.2181	379.8572	395.4953	425.5776	460.2094	486.9522 (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					16.6700	10.6334	0.4500	0.0000	0.7700		61.4201 (74)	
East					4.6700	19.6403	0.4500	0.0000	0.7700		31.7810 (76)	
South					12.0500	46.7521	0.4500	0.0000	0.7700		195.2051 (78)	

Solar gains	288.4062	499.2430	709.0734	929.9594	1094.1952	1110.9156	1060.6786	933.3850	784.2906	558.3141	346.7814	246.0131 (83)
Total gains	791.2133	999.7735	1191.3735	1382.4152	1515.5467	1502.8712	1433.8967	1313.2422	1179.7859	983.8916	806.9908	732.9654 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	21.0000 (85)											
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	60.3652	60.5073	60.6471	61.3128	61.4390	62.0332	62.0332	62.1445	61.8030	61.4390	61.1843	60.9202
alpha	5.0243	5.0338	5.0431	5.0875	5.0959	5.1355	5.1355	5.1430	5.1202	5.0959	5.0790	5.0613
util living area	0.9990	0.9965	0.9880	0.9550	0.8583	0.6818	0.5145	0.5790	0.8374	0.9782	0.9974	0.9993 (86)
MIT	19.6828	19.8779	20.1651	20.5247	20.8135	20.9582	20.9919	20.9856	20.8799	20.4871	20.0115	19.6502 (87)
Th 2	19.9599	19.9621	19.9642	19.9743	19.9762	19.9850	19.9850	19.9866	19.9816	19.9762	19.9723	19.9684 (88)
util rest of house	0.9986	0.9953	0.9837	0.9382	0.8095	0.5915	0.4006	0.4603	0.7642	0.9672	0.9963	0.9991 (89)
MIT 2	18.1949	18.4815	18.9001	19.4175	19.7958	19.9577	19.9820	19.9807	19.8856	19.3749	18.6846	18.1533 (90)
Living area fraction	18.3836	18.6585	19.0605	19.5579	19.9248	20.0846	20.1101	20.1082	20.0117	19.5159	18.8529	18.3431 (92)
Temperature adjustment	18.2336	18.5085	18.9105	19.4079	19.7748	19.9346	19.9601	19.9582	19.8617	19.3659	18.7029	18.1931 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9977	0.9926	0.9773	0.9262	0.7982	0.5867	0.3977	0.4568	0.7540	0.9577	0.9941	0.9984 (94)
Ext temp.	789.3584	992.3812	1164.3568	1280.3842	1209.7775	881.6878	570.2841	599.9485	889.5852	942.2277	802.2585	731.7807 (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	2443.5003	2380.8944	2166.2792	1814.2740	1391.3170	910.3597	573.4031	606.1224	986.9114	1510.3940	2007.5355	2431.5864 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1230.6816	933.0809	745.4303	384.4007	135.0654	0.0000	0.0000	0.0000	0.0000	422.7157	867.7995	1264.6555 (98)
												5983.8294 (98)
												39.2537 (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 %)													92.9000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6441.1512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1230.6816	933.0809	745.4303	384.4007	135.0654	0.0000	0.0000	0.0000	0.0000	422.7157	867.7995	1264.6555	(98)
Space heating efficiency (main heating system 1)	92.9000	92.9000	92.9000	92.9000	92.9000	0.0000	0.0000	0.0000	0.0000	92.9000	92.9000	92.9000	(210)
Space heating fuel (main heating system)	1324.7380	1004.3927	802.4007	413.7790	145.3879	0.0000	0.0000	0.0000	0.0000	455.0223	934.1221	1361.3084	(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	184.3383	161.6303	167.7541	147.6157	142.6476	124.5705	116.9007	132.0627	133.0196	153.2044	165.4741	178.9704	(64)
Efficiency of water heater (217)m	90.0699	90.0128	89.8947	89.5888	88.8276	87.3000	87.3000	87.3000	87.3000	89.6261	89.9719	90.0906	(217)
Fuel for water heating, kWh/month	204.6614	179.5636	186.6118	164.7703	160.5894	142.6924	133.9068	151.2745	152.3707	170.9374	183.9176	198.6560	(219)
Water heating fuel used												2029.9519	(219)
Annual totals kWh/year													
Space heating fuel - main system												6441.1512	(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)												509.0499	(232)
Total delivered energy for all uses												9055.1530	(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	6441.1512	0.2160	1391.2887 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.9519	0.2160	438.4696 (264)
Space and water heating			1829.7583 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	509.0499	0.5190	264.1969 (268)
Total CO2, kg/year			2132.8802 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9900 (273)

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

DER		13.9900	ZC1
Total Floor Area	TFA	152.4400	
Assumed number of occupants	N	2.9379	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5623	ZC2
CO2 emissions from cooking, equation (L16)		1.2432	ZC3
Total CO2 emissions		27.7955	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		27.7955	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	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					4 * 10 = 40.0000 (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 40.0000 / (5) = 0.1093 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3593 (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) =		0.3054 (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	0.3894	0.3818	0.3742	0.3360	0.3283	0.2902	0.2902	0.2825	0.3054	0.3283	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5466	0.5539	0.5590	0.5644 (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			2.2500	1.0000	2.2500		(26)
TER Opening Type (Uw = 1.40)			33.3900	1.3258	44.2670		(27)
Heat Loss Floor 1			64.1100	0.1300	8.3343		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.1800	31.9338		(29a)
External Roof 1	64.1100		64.1100	0.1300	8.3343		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.1194		(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)							22.3507 (36)
Total fabric heat loss						(33) + (36) =	117.4701 (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	69.5210	69.1655	68.8170	67.1804	66.8742	65.4487	65.4487	65.1847	65.9978	66.8742	67.4936	68.1413 (38)
Heat transfer coeff	186.9911	186.6356	186.2872	184.6505	184.3443	182.9188	182.9188	182.6549	183.4679	184.3443	184.9638	185.6114 (39)
Average = Sum(39)m / 12 =												184.6491 (39)
HLP	1.2267	1.2243	1.2220	1.2113	1.2093	1.1999	1.1999	1.1982	1.2035	1.2093	1.2134	1.2176 (40)
HLP (average)												1.2113 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy content (annual)	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Distribution loss (46)m = 0.15 x (45)m	25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.8059	46.1482	47.6865	49.8059	49.3151	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(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	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(64)
Heat gains from water heating, kWh/month	69.1359	60.8313	63.6381	56.7032	55.0298	48.2789	45.9684	51.5206	51.8645	58.8149	62.6234	67.3564	(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	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	(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)	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	(71)
Water heating gains (Table 5)	92.9246	90.5228	85.5351	78.7545	73.9648	67.0541	61.7855	69.2482	72.0341	79.0522	86.9769	90.5328	(72)
Total internal gains	514.9823	512.7110	494.4919	464.6629	433.1840	403.0944	384.3680	391.7001	407.7176	437.7840	472.3980	499.1327	(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	16.6700	10.6334	0.6300	0.7000	0.7700	54.1725	(74)
East	4.6700	19.6403	0.6300	0.7000	0.7700	28.0308	(76)
South	12.0500	46.7521	0.6300	0.7000	0.7700	172.1709	(78)

Solar gains	254.3742	440.3323	625.4027	820.2242	965.0802	979.8275	935.5185	823.2456	691.7443	492.4330	305.8612	216.9836	(83)
Total gains	769.3565	953.0433	1119.8946	1284.8871	1398.2642	1382.9219	1319.8865	1214.9457	1099.4618	930.2170	778.2591	716.1163	(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	56.6129	56.7207	56.8268	57.3305	57.4258	57.8733	57.8733	57.9569	57.7001	57.4258	57.2334	57.0337	
alpha	4.7742	4.7814	4.7885	4.8220	4.8284	4.8582	4.8582	4.8638	4.8467	4.8284	4.8156	4.8022	
util living area	0.9991	0.9972	0.9913	0.9693	0.9009	0.7537	0.5870	0.6515	0.8817	0.9841	0.9978	0.9993	(86)
MIT	19.5696	19.7512	20.0325	20.3975	20.7228	20.9217	20.9816	20.9703	20.8191	20.3894	19.9071	19.5378	(87)
Th 2	19.8987	19.9006	19.9024	19.9110	19.9126	19.9200	19.9200	19.9214	19.9172	19.9126	19.9093	19.9059	(88)
util rest of house	0.9987	0.9962	0.9880	0.9568	0.8596	0.6603	0.4543	0.5178	0.8164	0.9755	0.9968	0.9991	(89)
MIT 2	17.9868	18.2533	18.6642	19.1936	19.6341	19.8664	19.9132	19.9089	19.7656	19.1901	18.4879	17.9452	(90)
Living area fraction	18.1875	18.4433	18.8377	19.3463	19.7721	20.0003	20.0487	20.0434	19.8992	19.3422	18.6678	18.1471	(92)
Temperature adjustment	18.1875	18.4433	18.8377	19.3463	19.7721	20.0003	20.0487	20.0434	19.8992	19.3422	18.6678	18.1471	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9941	0.9833	0.9481	0.8531	0.6680	0.4709	0.5341	0.8151	0.9690	0.9951	0.9985	(94)
Ext temp.	767.7286	947.4238	1101.2417	1218.1374	1192.9203	923.8577	621.5913	648.8975	896.1466	901.3533	774.4492	715.0338	(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	2596.8388	2527.6548	2298.3562	1928.9110	1488.0496	987.8075	630.8333	665.4925	1063.9591	1611.5782	2139.6311	2588.7448	(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 per m2	1360.8580	1061.9152	890.6532	511.7570	219.5762	0.0000	0.0000	0.0000	0.0000	528.4073	982.9309	1394.0410	(98)
												6950.1389	(98)
												45.5926	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7441.2622 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1360.8580	1061.9152	890.6532	511.7570	219.5762	0.0000	0.0000	0.0000	0.0000	528.4073	982.9309	1394.0410	(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)	1457.0214	1136.9542	953.5902	547.9197	235.0923	0.0000	0.0000	0.0000	0.0000	565.7466	1052.3886	1492.5492	(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	220.5715	194.3716	204.0369	182.7721	177.8611	156.6501	150.0828	167.3071	168.2196	189.5307	200.5770	215.2196	(64)
Efficiency of water heater (217)m	88.8414	88.6744	88.3292	87.5036	85.5827	80.3000	80.3000	80.3000	80.3000	87.4948	88.5132	88.9045	(216)
Fuel for water heating, kWh/month	248.2754	219.1971	230.9958	208.8737	207.8237	195.0811	186.9026	208.3526	209.4890	216.6195	226.6069	242.0795	(219)
Water heating fuel used												2600.2969	(219)
Annual totals kWh/year													
Space heating fuel - main system												7441.2622	(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)												509.0499	(232)
Total delivered energy for all uses												10625.6090	(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	7441.2622	0.2160	1607.3126 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2600.2969	0.2160	561.6641 (264)
Space and water heating			2168.9768 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	509.0499	0.5190	264.1969 (268)
Total CO2, kg/m2/year			2472.0987 (272)
Emissions per m2 for space and water heating			14.2284 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7331 (272b)
Emissions per m2 for pumps and fans			0.2553 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2284 * 1.00) + 1.7331 + 0.2553, rounded to 2 d.p.			16.2200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE B (3B)				Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (B/3B)	Prop Type Ref	TYPE B / 3 BED / 3 STOREY			
Property	TYPE B / 3 BED / 3 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating		90 B	DER	9.56	TER	23.65
Environmental		91 B	% DER<TER	59.58		
CO ₂ Emissions (t/year)		1.26	DFEE	44.33	TFEE	58.08
General Requirements Compliance		Pass	% DFEE<TFEE	23.67		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Detached House, total floor area 152 m²

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

1a TER and DER

Fuel for main heating: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 23.65 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 9.56 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 58.1 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 44.3 kWh/m²/yr OK

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	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.11 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	16.67 m ² , No overhang
Windows facing East:	4.67 m ² , No overhang
Windows facing South:	12.05 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K

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	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					5 * 10 = 50.0000 (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 50.0000 / (5) = 0.1367 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3867 (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) =		0.3287 (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	0.4190	0.4108	0.4026	0.3615	0.3533	0.3122	0.3122	0.3040	0.3287	0.3533	0.3697	0.3862 (22b)
Effective ac	0.5878	0.5844	0.5810	0.5654	0.5624	0.5487	0.5487	0.5462	0.5540	0.5624	0.5684	0.5746 (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
WINDOW (Uw = 1.30)			33.3900	1.2357	41.2614		(27)
DOOR			2.2500	1.0000	2.2500		(26)
Heat Loss Floor 1			64.1100	0.1100	7.0521		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.2000	35.4820		(29a)
External Roof 1	64.1100		64.1100	0.1000	6.4110		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		92.4565		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							11.9445 (36)
Total fabric heat loss						(33) + (36) =	104.4010 (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	70.9667	70.5551	70.1516	68.2565	67.9019	66.2513	66.2513	65.9456	66.8871	67.9019	68.6192	69.3691 (38)
Heat transfer coeff	175.3676	174.9560	174.5525	172.6574	172.3028	170.6523	170.6523	170.3466	171.2880	172.3028	173.0201	173.7700 (39)
Average = Sum(39)m / 12 =												172.6557 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1504	1.1477	1.1451	1.1326	1.1303	1.1195	1.1195	1.1175	1.1236	1.1303	1.1350	1.1399 (40)
HLP (average)												1.1326 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy conte	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Energy content (annual)										Total = Sum(45)m =		1635.9456 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (46)	
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.1100 (48)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	211.4564	186.1386	194.9218	173.9511	169.8990	150.9959	144.2401	159.3450	159.3986	180.4156	191.7560	206.1045 (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	211.4564	186.1386	194.9218	173.9511	169.8990	150.9959	144.2401	159.3450	159.3986	180.4156	191.7560	206.1045 (64)
Heat gains from water heating, kWh/month	89.8712	79.5600	84.3735	76.7697	76.0534	69.1371	67.5218	72.5442	71.9310	79.5502	82.6898	88.0917 (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	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	(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)	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	(71)
Water heating gains (Table 5)	120.7946	118.3928	113.4052	106.6246	102.2223	96.0237	90.7551	97.5056	99.9041	106.9223	114.8470	118.4029	(72)
Total internal gains	539.8523	537.5811	519.3619	489.5330	458.4415	429.0640	410.3377	416.9576	432.5876	462.6540	497.2680	524.0028	(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					16.6700	10.6334	0.4500	0.0000			0.7700			61.4201 (74)
East					4.6700	19.6403	0.4500	0.0000			0.7700			31.7810 (76)
South					12.0500	46.7521	0.4500	0.0000			0.7700			195.2051 (78)
Solar gains	288.4062	499.2430	709.0734	929.9594	1094.1952	1110.9156	1060.6786	933.3850	784.2906	558.3141	346.7814	246.0131	(83)	
Total gains	828.2585	1036.8240	1228.4353	1419.4924	1552.6367	1539.9796	1471.0162	1350.3426	1216.8782	1020.9681	844.0494	770.0159	(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	60.3652	60.5073	60.6471	61.3128	61.4390	62.0332	62.0332	62.1445	61.8030	61.4390	61.1843	60.9202	
alpha	5.0243	5.0338	5.0431	5.0875	5.0959	5.1355	5.1355	5.1430	5.1202	5.0959	5.0790	5.0613	
util living area	0.9987	0.9959	0.9864	0.9504	0.8489	0.6690	0.5024	0.5649	0.8242	0.9747	0.9968	0.9991 (86)	
Tweekday	18.2281	18.5140	18.9306	19.4415	19.8075	19.9602	19.9823	19.9814	19.8943	19.4028	18.7174	18.1866	
Tweekend	20.1631	20.2891	20.4741	20.7043	20.8863	20.9752	20.9953	20.9917	20.9284	20.6815	20.3755	20.1421	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.7084	19.9003	20.1883	20.5383	20.8245	20.9619	20.9927	20.9872	20.8882	20.5085	20.0249	19.6760 (87)	
Th 2	19.9599	19.9621	19.9642	19.9743	19.9762	19.9850	19.9850	19.9866	19.9816	19.9762	19.9723	19.9684 (88)	
util rest of house	0.9983	0.9944	0.9815	0.9324	0.7985	0.5790	0.3907	0.4482	0.7488	0.9622	0.9955	0.9988 (89)	
Tweekday	18.2281	18.5140	18.9306	19.4415	19.8075	19.9602	19.9823	19.9814	19.8943	19.4028	18.7174	18.1866	
Tweekend	18.2281	18.5140	18.9306	19.4415	19.8075	19.9602	19.9823	19.9814	19.8943	19.4028	18.7174	18.1866	
MIT 2	18.2281	18.5140	18.9306	19.4415	19.8075	19.9602	19.9823	19.9814	19.8943	19.4028	18.7174	18.1866 (90)	
Living area fraction												fLA = Living area / (4) =	0.1268 (91)
MIT	18.4158	18.6898	19.0901	19.5806	19.9364	20.0872	20.1105	20.1089	20.0204	19.5430	18.8832	18.3755 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.4158	18.6898	19.0901	19.5806	19.9364	20.0872	20.1105	20.1089	20.0204	19.5430	18.8832	18.3755 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9973	0.9918	0.9758	0.9237	0.7962	0.5886	0.4048	0.4628	0.7521	0.9549	0.9933	0.9981	(94)
Ext temp.	826.0051	1028.3493	1198.7174	1311.1362	1236.2446	906.4724	595.5308	624.9795	915.2487	974.9354	838.4116	768.5435	(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	2475.4498	2412.6010	2197.6260	1844.0818	1419.1588	936.4062	599.0668	631.8066	1014.0875	1540.8999	2038.7349	2463.2724	(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	1227.1869	930.2172	743.1880	383.7208	136.0882	0.0000	0.0000	0.0000	0.0000	421.0776	864.2328	1260.8783	(98)
Space heating												5966.5897	(98)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 39.1406 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													387.5507 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1539.5638 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1227.1869	930.2172	743.1880	383.7208	136.0882	0.0000	0.0000	0.0000	0.0000	421.0776	864.2328	1260.8783	(98)
Space heating efficiency (main heating system 1)	387.5507	387.5507	387.5507	387.5507	387.5507	0.0000	0.0000	0.0000	0.0000	387.5507	387.5507	387.5507	(210)
Space heating fuel (main heating system)	316.6520	240.0247	191.7654	99.0118	35.1149	0.0000	0.0000	0.0000	0.0000	108.6510	222.9987	325.3454	(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	211.4564	186.1386	194.9218	173.9511	169.8990	150.9959	144.2401	159.3450	159.3986	180.4156	191.7560	206.1045	(64)
Efficiency of water heater	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
Fuel for water heating, kWh/month	75.5296	66.4864	69.6236	62.1332	60.6858	53.9339	51.5208	56.9161	56.9352	64.4422	68.4928	73.6180	(219)
Water heating fuel used												760.3174	(219)
Annual totals kWh/year													
Space heating fuel - main system												1539.5638	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												509.0499	(232)
Total delivered energy for all uses												2808.9311	(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	1539.5638	0.5190	799.0336	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	760.3174	0.5190	394.6047	(264)
Space and water heating			1193.6383	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	509.0499	0.5190	264.1969	(268)
Total CO2, kg/year			1457.8352	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.5600	(273)

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

DER		9.5600	ZC1
Total Floor Area	TFA	152.4400	
Assumed number of occupants	N	2.9379	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		12.5623	ZC2
CO2 emissions from cooking, equation (L16)		1.2432	ZC3
Total CO2 emissions		23.3655	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		23.3655	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	64.1100 (1b)	x 2.4000 (2b)	= 153.8640 (1b) - (3b)
First floor	54.4800 (1c)	x 2.4000 (2c)	= 130.7520 (1c) - (3c)
Second floor	33.8500 (1d)	x 2.4000 (2d)	= 81.2400 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	152.4400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 365.8560 (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					4 * 10 = 40.0000 (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 40.0000 / (5) = 0.1093 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3593 (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) =		0.3054 (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	0.3894	0.3818	0.3742	0.3360	0.3283	0.2902	0.2902	0.2825	0.3054	0.3283	0.3436	0.3589 (22b)
Effective ac	0.5758	0.5729	0.5700	0.5564	0.5539	0.5421	0.5421	0.5399	0.5466	0.5539	0.5590	0.5644 (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			2.2500	1.0000	2.2500		(26)
TER Opening Type (Uw = 1.40)			33.3900	1.3258	44.2670		(27)
Heat Loss Floor 1			64.1100	0.1300	8.3343		(28a)
External Wall 1	213.0500	35.6400	177.4100	0.1800	31.9338		(29a)
External Roof 1	64.1100		64.1100	0.1300	8.3343		(30)
Total net area of external elements Aum(A, m ²)			341.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		95.1194		(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)							22.3507 (36)
Total fabric heat loss						(33) + (36) =	117.4701 (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	69.5210	69.1655	68.8170	67.1804	66.8742	65.4487	65.4487	65.1847	65.9978	66.8742	67.4936	68.1413 (38)
Heat transfer coeff	186.9911	186.6356	186.2872	184.6505	184.3443	182.9188	182.9188	182.6549	183.4679	184.3443	184.9638	185.6114 (39)
Average = Sum(39)m / 12 =												184.6491 (39)
HLP	1.2267	1.2243	1.2220	1.2113	1.2093	1.1999	1.1999	1.1982	1.2035	1.2093	1.2134	1.2176 (40)
HLP (average)												1.2113 (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												2.9379 (42)
Average daily hot water use (litres/day)												103.9759 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	114.3735	110.2144	106.0554	101.8964	97.7373	93.5783	93.5783	97.7373	101.8964	106.0554	110.2144	114.3735 (44)
Energy content (annual)	169.6126	148.3442	153.0780	133.4571	128.0552	110.5019	102.3963	117.5012	118.9046	138.5718	151.2620	164.2607 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4419	22.2516	22.9617	20.0186	19.2083	16.5753	15.3594	17.6252	17.8357	20.7858	22.6893	24.6391 (46)	
Water storage loss:												
Store volume												180.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5520 (48)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
218.8552	192.8215	202.3206	181.1113	177.2979	158.1561	151.6390	166.7439	166.5588	187.8145	198.9162	213.5034	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
218.8552	192.8215	202.3206	181.1113	177.2979	158.1561	151.6390	166.7439	166.5588	187.8145	198.9162	213.5034	(64)
Heat gains from water heating, kWh/month												
95.7903	84.9063	90.2926	82.4978	81.9725	74.8653	73.4409	78.4633	77.6591	85.4693	88.4180	94.0108	(65)
Total per year (kWh/year) = Sum(64)m =												2215.7384 (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	
146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	146.8966	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
28.8245	25.6017	20.8207	15.7626	11.7827	9.9475	10.7486	13.9714	18.7524	23.8105	27.7904	29.6256	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
323.1642	326.5176	318.0671	300.0769	277.3675	256.0238	241.7650	238.4115	246.8621	264.8523	287.5617	308.9053	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	37.6897	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	-117.5173	(71)
Water heating gains (Table 5)												
128.7504	126.3486	121.3610	114.5803	110.1781	103.9795	98.7109	105.4614	107.8599	114.8780	122.8027	126.3586	(72)
Total internal gains												
550.8081	548.5369	530.3177	500.4888	469.3973	440.0198	421.2934	427.9134	443.5434	473.6098	508.2238	534.9586	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d		Gains W
North					16.6700	10.6334	0.6300		0.7000		0.7700	54.1725 (74)
East					4.6700	19.6403	0.6300		0.7000		0.7700	28.0308 (76)
South					12.0500	46.7521	0.6300		0.7000		0.7700	172.1709 (78)
Solar gains	254.3742	440.3323	625.4027	820.2242	965.0802	979.8275	935.5185	823.2456	691.7443	492.4330	305.8612	216.9836 (83)
Total gains	805.1823	988.8692	1155.7204	1320.7129	1434.4774	1419.8473	1356.8119	1251.1589	1135.2877	966.0428	814.0849	751.9421 (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	
56.6129	56.7207	56.8268	57.3305	57.4258	57.8733	57.8733	57.9569	57.7001	57.4258	57.2334	57.0337	
alpha	4.7742	4.7814	4.7885	4.8220	4.8284	4.8582	4.8638	4.8467	4.8284	4.8156	4.8022	
util living area	0.9989	0.9967	0.9901	0.9660	0.8932	0.7408	0.5732	0.6363	0.8708	0.9815	0.9973	0.9992 (86)
MIT	19.5913	19.7726	20.0533	20.4160	20.7360	20.9275	20.9834	20.9731	20.8308	20.4094	19.9286	19.5595 (87)
Th 2	19.8987	19.9006	19.9024	19.9110	19.9126	19.9200	19.9200	19.9214	19.9172	19.9126	19.9093	19.9059 (88)
util rest of house	0.9984	0.9955	0.9864	0.9524	0.8500	0.6468	0.4426	0.5041	0.8024	0.9718	0.9962	0.9989 (89)
MIT 2	18.0184	18.2845	18.6941	19.2190	19.6495	19.8710	19.9140	19.9102	19.7775	19.2181	18.5192	17.9769 (90)
Living area fraction	0.9984	0.9955	0.9864	0.9524	0.8500	0.6468	0.4426	0.5041	0.8024	0.9718	0.9962	0.9989 (89)
MIT	18.2179	18.4732	18.8664	19.3708	19.7873	20.0050	20.0496	20.0450	19.9110	19.3692	18.6980	18.1776 (92)
Temperature adjustment	18.2179	18.4732	18.8664	19.3708	19.7873	20.0050	20.0496	20.0450	19.9110	19.3692	18.6980	18.1776 (93)
adjusted MIT	18.2179	18.4732	18.8664	19.3708	19.7873	20.0050	20.0496	20.0450	19.9110	19.3692	18.6980	18.1776 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9974	0.9932	0.9813	0.9434	0.8440	0.6549	0.4590	0.5203	0.8019	0.9647	0.9941	0.9981	(94)
Useful gains	803.1256	982.1281	1134.1454	1245.9691	1210.6824	929.8783	622.7126	650.9255	910.3988	931.9835	809.3141	750.5459	(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	2602.5181	2533.2465	2303.7045	1933.4438	1490.8431	988.6695	630.9904	665.7757	1066.1374	1616.5454	2145.2019	2594.4034	(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	1338.7480	1042.3516	870.1520	494.9818	208.4396	0.0000	0.0000	0.0000	0.0000	509.3140	961.8392	1371.8300	(98)
Space heating												6797.6562	(98)
Space heating per m2												44.5923	(99)
												(98) / (4) =	

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7270.2205 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1338.7480	1042.3516	870.1520	494.9818	208.4396	0.0000	0.0000	0.0000	0.0000	509.3140	961.8392	1371.8300	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1431.8160	1114.8145	930.6438	529.3923	222.9300	0.0000	0.0000	0.0000	0.0000	544.7209	1028.7050	1467.1979	(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	218.8552	192.8215	202.3206	181.1113	177.2979	158.1561	151.6390	166.7439	166.5588	187.8145	198.9162	213.5034	(64)
Efficiency of water heater (217)m	88.8265	88.6445	88.2673	87.3621	85.2463	79.8000	79.8000	79.8000	79.8000	87.3447	88.4672	88.8948	(216)
Fuel for water heating, kWh/month	246.3851	217.5222	229.2136	207.3111	207.9832	198.1906	190.0238	208.9523	208.7203	215.0267	224.8473	240.1755	(219)
Water heating fuel used												2594.3516	(219)
Annual totals kWh/year													
Space heating fuel - main system												7270.2205	(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)												509.0499	(232)
Total delivered energy for all uses												10448.6220	(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	7270.2205	0.2160	1570.3676 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2594.3516	0.2160	560.3799 (264)
Space and water heating			2130.7476 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	509.0499	0.5190	264.1969 (268)
Total CO2, kg/m2/year			2433.8695 (272)
Emissions per m2 for space and water heating			13.9776 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			1.7331 (272b)
Emissions per m2 for pumps and fans			0.2553 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9776 * 1.55) + 1.7331 + 0.2553, rounded to 2 d.p.			23.6500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE FOG			Issued on Date	10/12/2021
Assessment Reference	002 BE LEAN (FOG)	Prop Type Ref	TYPE FOG / 2 BED / 1 STOREY		
Property	TYPE FOG / 2 BED / 1 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4				
SAP Rating	83 B	DER	19.06	TER	21.06
Environmental	85 B	% DER<TER	9.52		
CO ₂ Emissions (t/year)	1.45	DFEE	51.69	TFEE	66.78
General Requirements Compliance	Pass	% DFEE<TFEE	22.60		
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk			Assessor ID	T293-0001
Client	Beechcroft Homes, BEE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 91 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.06 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.06 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 66.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 51.7 kWh/m²/yr OK

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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified ψ -value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.78 m², No overhang
Windows facing South: 3.98 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging ψ -value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1377 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3877 (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) =	0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (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
WINDOW (Uw = 1.30)			8.7600	1.2357	10.8251		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			3.5700	0.1100	0.3927		(28a)
Heat Loss Floor 2			83.6200	0.1500	12.5430		(28a)
External Wall 1	117.8600	10.8200	107.0400	0.2000	21.4080		(29a)
External Roof 1	87.1900		87.1900	0.1000	8.7190		(30)
Total net area of external elements Aum(A, m ²)			292.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9478		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							10.2284 (36)
Total fabric heat loss						(33) + (36) =	66.1762 (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	42.2869	42.0405	41.7990	40.6644	40.4522	39.4641	39.4641	39.2811	39.8447	40.4522	40.8816	41.3305 (38)
Heat transfer coeff	108.4631	108.2167	107.9752	106.8406	106.6284	105.6402	105.6402	105.4573	106.0209	106.6284	107.0578	107.5067 (39)
Average = Sum(39)m / 12 =												106.8396 (39)
HLP	1.1951	1.1923	1.1897	1.1772	1.1748	1.1640	1.1640	1.1619	1.1681	1.1748	1.1796	1.1845 (40)
HLP (average)												1.1772 (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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.4850	102.6128	98.7406	94.8685	90.9963	87.1241	87.1241	90.9963	94.8685	98.7406	102.6128	106.4850 (44)
Energy content (annual)	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	0.0000	(57)
Combi loss	14.6907	13.2554	14.6391	14.1119	14.5424	14.0272	14.4661	14.5156	14.0734	14.5991	14.1808	14.6757	14.6757	(61)
Total heat required for water heating calculated for each month	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072	167.6072	(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	0.0000	(63)
Output from w/h	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072	167.6072	(64)
Heat gains from water heating, kWh/month	56.1791	49.2363	51.0477	44.8419	43.2773	37.7146	35.3150	40.0034	40.3273	46.5470	50.3709	54.5186	54.5186	(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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(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	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)	75.5096	73.2684	68.6125	62.2804	58.1684	52.3813	47.4665	53.7680	56.0101	62.5632	69.9596	73.2777	73.2777	(72)
Total internal gains	406.4570	403.9227	388.8422	364.7473	340.2937	317.0368	302.2050	308.7996	321.4663	345.7822	373.5202	394.3081	394.3081	(73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d	W	
North					4.7800	10.6334	0.4500		0.0000	0.7700	17.6118	
South					3.9800	46.7521	0.4500		0.0000	0.7700	64.4744 (78)	
Solar gains	82.0861	139.2494	191.6974	243.8851	282.1647	284.9305	272.6406	242.7848	209.2700	153.9556	98.1505	70.3938 (83)
Total gains	488.5431	543.1721	580.5397	608.6324	622.4584	601.9674	574.8455	551.5844	530.7363	499.7378	471.6707	464.7020 (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	58.1099	58.2422	58.3725	58.9923	59.1098	59.6627	59.6627	59.7662	59.4485	59.1098	58.8727	58.6268	
alpha	4.8740	4.8828	4.8915	4.9328	4.9407	4.9775	4.9775	4.9844	4.9632	4.9407	4.9248	4.9085	
util living area	0.9988	0.9977	0.9951	0.9870	0.9602	0.8771	0.7338	0.7753	0.9345	0.9892	0.9976	0.9991 (86)	
MIT	19.6417	19.7674	19.9850	20.2874	20.5942	20.8471	20.9557	20.9407	20.7570	20.3669	19.9527	19.6202 (87)	
Th 2	19.9240	19.9261	19.9283	19.9383	19.9402	19.9489	19.9489	19.9506	19.9456	19.9402	19.9364	19.9324 (88)	
util rest of house	0.9983	0.9968	0.9932	0.9811	0.9390	0.8053	0.5931	0.6438	0.8897	0.9832	0.9966	0.9987 (89)	
MIT 2	18.6853	18.8124	19.0310	19.3388	19.6372	19.8661	19.9357	19.9306	19.7934	19.4204	19.0058	18.6704 (90)	
Living area fraction	18.9627	19.0894	19.3078	19.6140	19.9148	20.1507	20.2316	20.2236	20.0730	19.6950	19.2805	18.9460 (92)	
MIT	18.8127	18.9394	19.1578	19.4640	19.7648	20.0007	20.0816	20.0736	19.9230	19.5450	19.1305	18.7960 (93)	
Temperature adjustment												-0.1500	
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	487.4176	540.8673	575.4395	594.9531	581.6573	487.3577	352.3798	364.8720	471.5435	489.7621	469.5417	463.8685	463.8685	(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	4.2000	(96)
Heat loss rate W	1574.0974	1519.3015	1366.7265	1128.6651	859.9387	570.5295	367.7952	387.4102	617.3549	953.7897	1287.9576	1569.1632	1569.1632	(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	1.0000	(97a)
Space heating kWh	808.4897	657.5078	588.7175	384.2726	207.0414	0.0000	0.0000	0.0000	0.0000	345.2365	589.2595	822.3393	822.3393	(98)
Space heating												4402.8642	4402.8642	(98)
Space heating per m2												(98) / (4) =	48.5111	(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												4865.0434 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	808.4897	657.5078	588.7175	384.2726	207.0414	0.0000	0.0000	0.0000	0.0000	345.2365	589.2595	822.3393 (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)	893.3588	726.5280	650.5166	424.6106	228.7750	0.0000	0.0000	0.0000	0.0000	381.4768	651.1154	908.6622 (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	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072 (64)
Efficiency of water heater (217)m	89.9201	89.8835	89.8064	89.6302	89.2164	87.3000	87.3000	87.3000	87.3000	89.5358	89.8143	87.3000 (216)
Fuel for water heating, kWh/month	191.9535	168.4049	174.9976	154.3724	149.9337	133.9149	125.7732	141.9388	142.9289	160.3977	172.5894	186.3506 (219)
Water heating fuel used												1903.5557 (219)
Annual totals kWh/year												
Space heating fuel - main system												4865.0434 (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)												440.4251 (232)
Total delivered energy for all uses												7284.0242 (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	4865.0434	0.2160	1050.8494 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.5557	0.2160	411.1680 (264)
Space and water heating			1462.0174 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/year			1729.5230 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.0600 (273)

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

DER		19.0600 ZC1
Total Floor Area	TFA	90.7600
Assumed number of occupants	N	2.6360
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.7004 ZC2
CO2 emissions from cooking, equation (L16)		2.0082 ZC3
Total CO2 emissions		36.7686 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		36.7686 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	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1377 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3877 (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) =	0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			8.7600	1.3258	11.6136		(27)
Heat Loss Floor 1			3.5700	0.1300	0.4641		(28a)
Heat Loss Floor 2			83.6200	0.1300	10.8706		(28a)
External Wall 1	117.8600	10.8200	107.0400	0.1800	19.2672		(29a)
External Roof 1	87.1900		87.1900	0.1300	11.3347		(30)
Total net area of external elements Aum(A, m ²)			292.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6102		(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)							19.1748 (36)
Total fabric heat loss						(33) + (36) =	74.7850 (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	42.2869	42.0405	41.7990	40.6644	40.4522	39.4641	39.4641	39.2811	39.8447	40.4522	40.8816	41.3305 (38)
Heat transfer coeff	117.0720	116.8255	116.5840	115.4495	115.2372	114.2491	114.2491	114.0661	114.6297	115.2372	115.6666	116.1156 (39)
Average = Sum(39)m / 12 =												115.4485 (39)
HLP	1.2899	1.2872	1.2845	1.2720	1.2697	1.2588	1.2588	1.2568	1.2630	1.2697	1.2744	1.2794 (40)
HLP (average)												1.2720 (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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.4850	102.6128	98.7406	94.8685	90.9963	87.1241	87.1241	90.9963	94.8685	98.7406	102.6128	106.4850 (44)
Energy content (annual)	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000	(57)
Combi loss	50.9589	46.0274	50.3171	46.7844	46.3707	42.9653	44.3975	46.3707	46.7844	50.3171	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	155.7677	157.4880	179.3315	190.1443	203.8904	(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	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	Solar input (sum of months) = Sum (63)m =					0.0000	(63)
	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	155.7677	157.4880	179.3315	190.1443	203.8904	(64)	
	Total per year (kWh/year) = Sum (64)m =											2094.6801	(64)	
Heat gains from water heating, kWh/month	65.2462	57.4293	59.9672	53.0100	51.2344	44.9491	42.7979	47.9672	48.5051	55.4766	59.1545	63.5894	(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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(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)	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)	87.6965	85.4603	80.6010	73.6250	68.8634	62.4293	57.5240	64.4720	67.3681	74.5653	82.1590	85.4697	(72)
Total internal gains	418.6439	416.1147	400.8308	376.0919	350.9887	327.0848	312.2625	319.5036	332.8243	357.7843	385.7196	406.5001	(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	4.7800				10.6334		0.6300		0.7000		0.7700		15.5336	
South	3.9800				46.7521		0.6300		0.7000		0.7700		56.8664 (78)	
Solar gains	72.4000	122.8180	169.0771	215.1067	248.8692	251.3087	240.4690	214.1362	184.5762	135.7888	86.5687	62.0874 (83)		
Total gains	491.0439	538.9327	569.9080	591.1986	599.8579	578.3935	552.7315	533.6398	517.4005	493.5731	472.2884	468.5874 (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	53.8368	53.9503	54.0621	54.5934	54.6939	55.1670	55.1670	55.2555	54.9838	54.6939	54.4909	54.2802	
alpha	4.5891	4.5967	4.6041	4.6396	4.6463	4.6778	4.6778	4.6837	4.6656	4.6463	4.6327	4.6187	
util living area	0.9987	0.9977	0.9956	0.9892	0.9691	0.9051	0.7827	0.8170	0.9475	0.9904	0.9976	0.9990	(86)
MIT	19.5220	19.6440	19.8656	20.1779	20.5034	20.7893	20.9289	20.9100	20.6951	20.2814	19.8499	19.5011	(87)
Th 2	19.8487	19.8509	19.8530	19.8628	19.8647	19.8732	19.8732	19.8748	19.8699	19.8647	19.8609	19.8570	(88)
util rest of house	0.9982	0.9969	0.9938	0.9842	0.9514	0.8402	0.6371	0.6846	0.9078	0.9849	0.9965	0.9986	(89)
MIT 2	17.8829	18.0626	18.3879	18.8490	19.3156	19.7002	19.8408	19.8287	19.5853	19.0021	18.3710	17.8580	(90)
Living area fraction									fLA = Living area / (4) =			0.2901	(91)
MIT	18.3584	18.5214	18.8166	19.2345	19.6602	20.0161	20.1565	20.1424	19.9072	19.3732	18.8000	18.3346	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3584	18.5214	18.8166	19.2345	19.6602	20.0161	20.1565	20.1424	19.9072	19.3732	18.8000	18.3346	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	489.7035	536.4695	565.0000	579.5005	568.1257	491.9165	375.4255	385.1137	470.6106	484.3846	469.9391	467.5622	(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	1645.8457	1591.3274	1435.9161	1193.1157	917.3109	618.7862	406.3234	426.8768	665.6820	1011.0031	1353.3029	1641.2520	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	860.1698	708.8645	647.9616	441.8030	259.7938	0.0000	0.0000	0.0000	0.0000	391.8041	636.0219	873.2252	(98)
Space heating												4819.6440	(98)
Space heating per m2												53.1032	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5160.2184 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.1698	708.8645	647.9616	441.8030	259.7938	0.0000	0.0000	0.0000	0.0000	391.8041	636.0219	873.2252	(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)	920.9527	758.9556	693.7490	473.0225	278.1518	0.0000	0.0000	0.0000	0.0000	419.4905	680.9657	934.9307	(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	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	155.7677	157.4880	179.3315	190.1443	203.8904	(64)
Efficiency of water heater (217)m	88.2317	88.1147	87.8653	87.3343	86.1804	80.3000	80.3000	80.3000	80.3000	86.9654	87.8567	80.3000	(216)
Fuel for water heating, kWh/month	236.7324	208.9778	219.4690	195.8416	192.1479	181.6261	174.0117	193.9822	196.1246	206.2100	216.4255	230.9124	(219)
Water heating fuel used												2452.4613	(219)
Annual totals kWh/year													
Space heating fuel - main system												5160.2184	(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)												440.4251	(232)
Total delivered energy for all uses												8128.1048	(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	5160.2184	0.2160	1114.6072 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2452.4613	0.2160	529.7316 (264)
Space and water heating			1644.3388 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/m2/year			1911.8444 (272)
Emissions per m2 for space and water heating			18.1174 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5185 (272b)
Emissions per m2 for pumps and fans			0.4289 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.1174 * 1.00) + 2.5185 + 0.4289, rounded to 2 d.p.			21.0600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE FOG				Issued on Date	10/12/2021
Assessment Reference	003 BE CLEAN (FOG)	Prop Type Ref	TYPE FOG / 2 BED / 1 STOREY			
Property	TYPE FOG / 2 BED / 1 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	84 B	DER	18.24	TER	21.06	
Environmental	85 B	% DER<TER	13.41			
CO ₂ Emissions (t/year)	1.39	DFEE	51.69	TFEE	66.78	
General Requirements Compliance	Pass	% DFEE<TFEE	22.60			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

DWELLING AS DESIGNED

Top-floor flat, total floor area 91 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 21.06 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.24 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)66.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 30
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

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK
Based on:
Overshading: Average
Windows facing North: 4.78 m², No overhang
Windows facing South: 3.98 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.035 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1377 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3877 (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) =					0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872	(22b)				
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750	(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						
WINDOW (Uw = 1.30)			8.7600	1.2357	10.8251			(27)					
DOOR			2.0600	1.0000	2.0600			(26)					
Heat Loss Floor 1			3.5700	0.1100	0.3927			(28a)					
Heat Loss Floor 2			83.6200	0.1500	12.5430			(28a)					
External Wall 1	117.8600	10.8200	107.0400	0.2000	21.4080			(29a)					
External Roof 1	87.1900		87.1900	0.1000	8.7190			(30)					
Total net area of external elements Aum(A, m2)			292.2400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	55.9478		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (User defined value 0.035 * total exposed area)								10.2284 (36)					
Total fabric heat loss						(33) + (36) =		66.1762 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.2869	Feb 42.0405	Mar 41.7990	Apr 40.6644	May 40.4522	Jun 39.4641	Jul 39.4641	Aug 39.2811	Sep 39.8447	Oct 40.4522	Nov 40.8816	Dec 41.3305	(38)
Heat transfer coeff	108.4631	108.2167	107.9752	106.8406	106.6284	105.6402	105.6402	105.4573	106.0209	106.6284	107.0578	107.5067	(39)
Average = Sum(39)m / 12 =												106.8396	(39)
HLP	Jan 1.1951	Feb 1.1923	Mar 1.1897	Apr 1.1772	May 1.1748	Jun 1.1640	Jul 1.1640	Aug 1.1619	Sep 1.1681	Oct 1.1748	Nov 1.1796	Dec 1.1845	(40)
HLP (average)												1.1772	(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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan 106.4850	Feb 102.6128	Mar 98.7406	Apr 94.8685	May 90.9963	Jun 87.1241	Jul 87.1241	Aug 90.9963	Sep 94.8685	Oct 98.7406	Nov 102.6128	Dec 106.4850 (44)
Energy conte	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Energy content (annual)										Total = Sum(45)m =		1523.1124 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	14.6907	13.2554	14.6391	14.1119	14.5424	14.0272	14.4661	14.5156	14.0734	14.5991	14.1808	14.6757	(61)
Total heat required for water heating calculated for each month	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072	(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	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072	(64)
Heat gains from water heating, kWh/month	56.1791	49.2363	51.0477	44.8419	43.2773	37.7146	35.3150	40.0034	40.3273	46.5470	50.3709	54.5186	(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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(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)	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)	75.5096	73.2684	68.6125	62.2804	58.1684	52.3813	47.4665	53.7680	56.0101	62.5632	69.9596	73.2777	(72)
Total internal gains	406.4570	403.9227	388.8422	364.7473	340.2937	317.0368	302.2050	308.7996	321.4663	345.7822	373.5202	394.3081	(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	4.7800				10.6334		0.4500		0.0000		0.7700		17.6118	
South	3.9800				46.7521		0.4500		0.0000		0.7700		64.4744 (78)	
Solar gains	82.0861	139.2494	191.6974	243.8851	282.1647	284.9305	272.6406	242.7848	209.2700	153.9556	98.1505	70.3938 (83)		
Total gains	488.5431	543.1721	580.5397	608.6324	622.4584	601.9674	574.8455	551.5844	530.7363	499.7378	471.6707	464.7020 (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	58.1099	58.2422	58.3725	58.9923	59.1098	59.6627	59.6627	59.7662	59.4485	59.1098	58.8727	58.6268	
alpha	4.8740	4.8828	4.8915	4.9328	4.9407	4.9775	4.9775	4.9844	4.9632	4.9407	4.9248	4.9085	
util living area	0.9988	0.9977	0.9951	0.9870	0.9602	0.8771	0.7338	0.7753	0.9345	0.9892	0.9976	0.9991 (86)	
MIT	19.6417	19.7674	19.9850	20.2874	20.5942	20.8471	20.9557	20.9407	20.7570	20.3669	19.9527	19.6202 (87)	
Th 2	19.9240	19.9261	19.9283	19.9383	19.9402	19.9489	19.9489	19.9506	19.9456	19.9402	19.9364	19.9324 (88)	
util rest of house	0.9983	0.9968	0.9932	0.9811	0.9390	0.8053	0.5931	0.6438	0.8897	0.9832	0.9966	0.9987 (89)	
MIT 2	18.1097	18.2949	18.6141	19.0603	19.4964	19.8276	19.9295	19.9213	19.7227	19.1789	18.5734	18.0841 (90)	
Living area fraction	18.5542	18.7221	19.0118	19.4163	19.8149	20.1233	20.2272	20.2170	20.0228	fLA = Living area / (4) =			0.2901 (91)
MIT	18.5542	18.7221	19.0118	19.4163	19.8149	20.1233	20.2272	20.2170	20.0228	19.5235	18.9735	18.5297 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.4042	18.5721	18.8618	19.2663	19.6649	19.9733	20.0772	20.0670	19.8728	19.3735	18.8235	18.3797 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	487.2661	540.5869	574.9096	593.9060	579.9300	485.9966	352.0075	364.3565	470.0391	488.9685	469.2882	463.7530	(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	1529.7812	1479.5460	1334.7708	1107.5385	849.2823	567.6416	367.3330	386.7154	612.0334	935.5084	1255.0955	1524.4123	(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	775.6312	630.9805	565.3368	369.8154	200.3981	0.0000	0.0000	0.0000	0.0000	332.2257	565.7813	789.1305	(98)
Space heating												4229.2995	(98)
Space heating per m2												46.5987	(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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4523.3150 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	775.6312	630.9805	565.3368	369.8154	200.3981	0.0000	0.0000	0.0000	0.0000	332.2257	565.7813	789.1305	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	829.5521	674.8455	604.6382	395.5244	214.3295	0.0000	0.0000	0.0000	0.0000	355.3216	605.1137	843.9898	(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	172.6048	151.3682	157.1591	138.3643	133.7655	116.9077	109.8000	123.9126	124.7769	143.6134	155.0100	167.6072	(64)
Efficiency of water heater (217)m	89.9002	89.8627	89.7841	89.6057	89.1913	87.3000	87.3000	87.3000	87.3000	89.5098	89.7922	87.3000	(216)
Fuel for water heating, kWh/month	191.9961	168.4438	175.0410	154.4146	149.9760	133.9149	125.7732	141.9388	142.9289	160.4444	172.6320	186.3905	(219)
Water heating fuel used												1903.8943	(219)
Annual totals kWh/year													
Space heating fuel - main system												4523.3150	(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)												440.4251	(232)
Total delivered energy for all uses												6942.6344	(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	4523.3150	0.2160	977.0360 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.8943	0.2160	411.2412 (264)
Space and water heating			1388.2772 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/year			1655.7828 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2400 (273)

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

DER		18.2400	ZC1
Total Floor Area	TFA	90.7600	
Assumed number of occupants	N	2.6360	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.7004	ZC2
CO2 emissions from cooking, equation (L16)		2.0082	ZC3
Total CO2 emissions		35.9486	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		35.9486	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	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1377 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3877 (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) =	0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			8.7600	1.3258	11.6136		(27)
Heat Loss Floor 1			3.5700	0.1300	0.4641		(28a)
Heat Loss Floor 2			83.6200	0.1300	10.8706		(28a)
External Wall 1	117.8600	10.8200	107.0400	0.1800	19.2672		(29a)
External Roof 1	87.1900		87.1900	0.1300	11.3347		(30)
Total net area of external elements Aum(A, m ²)			292.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.6102		(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)							19.1748 (36)
Total fabric heat loss						(33) + (36) =	74.7850 (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	42.2869	42.0405	41.7990	40.6644	40.4522	39.4641	39.4641	39.2811	39.8447	40.4522	40.8816	41.3305 (38)
Heat transfer coeff	117.0720	116.8255	116.5840	115.4495	115.2372	114.2491	114.2491	114.0661	114.6297	115.2372	115.6666	116.1156 (39)
Average = Sum(39)m / 12 =												115.4485 (39)
HLP	1.2899	1.2872	1.2845	1.2720	1.2697	1.2588	1.2588	1.2568	1.2630	1.2697	1.2744	1.2794 (40)
HLP (average)												1.2720 (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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.4850	102.6128	98.7406	94.8685	90.9963	87.1241	87.1241	90.9963	94.8685	98.7406	102.6128	106.4850 (44)
Energy content (annual)	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000	(57)
Combi loss	50.9589	46.0274	50.3171	46.7844	46.3707	42.9653	44.3975	46.3707	46.7844	50.3171	49.3151	50.9589	(61)	
Total heat required for water heating calculated for each month	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	155.7677	157.4880	179.3315	190.1443	203.8904	(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	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	Solar input (sum of months) = Sum (63)m =					0.0000	(63)
Heat gains from water heating, kWh/month	65.2462	57.4293	59.9672	53.0100	51.2344	44.9491	42.7979	47.9672	48.5051	55.4766	59.1545	63.5894	(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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(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)	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)	87.6965	85.4603	80.6010	73.6250	68.8634	62.4293	57.5240	64.4720	67.3681	74.5653	82.1590	85.4697	(72)
Total internal gains	418.6439	416.1147	400.8308	376.0919	350.9887	327.0848	312.2625	319.5036	332.8243	357.7843	385.7196	406.5001	(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	4.7800				10.6334		0.6300		0.7000		0.7700		15.5336	
South	3.9800				46.7521		0.6300		0.7000		0.7700		56.8664 (78)	
Solar gains	72.4000	122.8180	169.0771	215.1067	248.8692	251.3087	240.4690	214.1362	184.5762	135.7888	86.5687	62.0874 (83)		
Total gains	491.0439	538.9327	569.9080	591.1986	599.8579	578.3935	552.7315	533.6398	517.4005	493.5731	472.2884	468.5874 (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	53.8368	53.9503	54.0621	54.5934	54.6939	55.1670	55.1670	55.2555	54.9838	54.6939	54.4909	54.2802	
alpha	4.5891	4.5967	4.6041	4.6396	4.6463	4.6778	4.6778	4.6837	4.6656	4.6463	4.6327	4.6187	
util living area	0.9987	0.9977	0.9956	0.9892	0.9691	0.9051	0.7827	0.8170	0.9475	0.9904	0.9976	0.9990	(86)
MIT	19.5220	19.6440	19.8656	20.1779	20.5034	20.7893	20.9289	20.9100	20.6951	20.2814	19.8499	19.5011	(87)
Th 2	19.8487	19.8509	19.8530	19.8628	19.8647	19.8732	19.8732	19.8748	19.8699	19.8647	19.8609	19.8570	(88)
util rest of house	0.9982	0.9969	0.9938	0.9842	0.9514	0.8402	0.6371	0.6846	0.9078	0.9849	0.9965	0.9986	(89)
MIT 2	17.8829	18.0626	18.3879	18.8490	19.3156	19.7002	19.8408	19.8287	19.5853	19.0021	18.3710	17.8580	(90)
Living area fraction									fLA = Living area / (4) =			0.2901	(91)
MIT	18.3584	18.5214	18.8166	19.2345	19.6602	20.0161	20.1565	20.1424	19.9072	19.3732	18.8000	18.3346	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3584	18.5214	18.8166	19.2345	19.6602	20.0161	20.1565	20.1424	19.9072	19.3732	18.8000	18.3346	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	489.7035	536.4695	565.0000	579.5005	568.1257	491.9165	375.4255	385.1137	470.6106	484.3846	469.9391	467.5622	(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	1645.8457	1591.3274	1435.9161	1193.1157	917.3109	618.7862	406.3234	426.8768	665.6820	1011.0031	1353.3029	1641.2520	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	860.1698	708.8645	647.9616	441.8030	259.7938	0.0000	0.0000	0.0000	0.0000	391.8041	636.0219	873.2252	(98)
Space heating												4819.6440	(98)
Space heating per m2												53.1032	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5160.2184 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	860.1698	708.8645	647.9616	441.8030	259.7938	0.0000	0.0000	0.0000	0.0000	391.8041	636.0219	873.2252	(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)	920.9527	758.9556	693.7490	473.0225	278.1518	0.0000	0.0000	0.0000	0.0000	419.4905	680.9657	934.9307	(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	208.8731	184.1401	192.8371	171.0368	165.5938	145.8458	139.7314	155.7677	157.4880	179.3315	190.1443	203.8904	(64)
Efficiency of water heater (217)m	88.2317	88.1147	87.8653	87.3343	86.1804	80.3000	80.3000	80.3000	80.3000	86.9654	87.8567	80.3000	(216)
Fuel for water heating, kWh/month	236.7324	208.9778	219.4690	195.8416	192.1479	181.6261	174.0117	193.9822	196.1246	206.2100	216.4255	230.9124	(219)
Water heating fuel used												2452.4613	(219)
Annual totals kWh/year													
Space heating fuel - main system												5160.2184	(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)												440.4251	(232)
Total delivered energy for all uses												8128.1048	(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	5160.2184	0.2160	1114.6072 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2452.4613	0.2160	529.7316 (264)
Space and water heating			1644.3388 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/m2/year			1911.8444 (272)
Emissions per m2 for space and water heating			18.1174 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5185 (272b)
Emissions per m2 for pumps and fans			0.4289 (272c)
Target Carbon Dioxide Emission Rate (TER) = (18.1174 * 1.00) + 2.5185 + 0.4289, rounded to 2 d.p.			21.0600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	BEE/0008/21 TYPE FOG				Issued on Date	10/12/2021
Assessment Reference	004 BE GREEN (FOG)		Prop Type Ref	TYPE FOG / 2 BED / 1 STOREY		
Property	TYPE FOG / 2 BED / 1 STOREY, Caversham Park, Caversham, Reading, BERKSHIRE, RG4					
SAP Rating	88 B	DER	13.80	TER	30.43	
Environmental	89 B	% DER<TER	54.65			
CO ₂ Emissions (t/year)	1.08	DFEE	51.69	TFEE	66.78	
General Requirements Compliance	Pass	% DFEE<TFEE	22.60			
Assessor Details	Mrs. Georgina O'Connor, Resi Resolve, Tel: 07748778047, georgie@resi-resolve.co.uk				Assessor ID	T293-0001
Client	Beechcroft Homes, BEE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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DWELLING AS DESIGNED

Top-floor flat, total floor area 91 m²

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

1a TER and DER

Fuel for main heating:Electricity

Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 30.43 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.80 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)66.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.7 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	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.24 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated using user-specified y-value of 0.035

3 Air permeability

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

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
Vaillant aroTHERM plus 7kW + AI VWL75/6A230VS2+VWZAMB2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.11 kWh/day	
Permitted by DBSCG 2.10	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	4.78 m ² , No overhang
Windows facing South:	3.98 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Thermal bridging y-value	0.035 W/m ² K

FULL SAP CALCULATION PRINTOUT

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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	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1377 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3877 (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) =	0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (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
WINDOW (Uw = 1.30)			8.7600	1.2357	10.8251		(27)
DOOR			2.0600	1.0000	2.0600		(26)
Heat Loss Floor 1			3.5700	0.1100	0.3927		(28a)
Heat Loss Floor 2			83.6200	0.1500	12.5430		(28a)
External Wall 1	117.8600	10.8200	107.0400	0.2000	21.4080		(29a)
External Roof 1	87.1900		87.1900	0.1000	8.7190		(30)
Total net area of external elements Aum(A, m ²)			292.2400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		55.9478		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (User defined value 0.035 * total exposed area)							10.2284 (36)
Total fabric heat loss						(33) + (36) =	66.1762 (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	42.2869	42.0405	41.7990	40.6644	40.4522	39.4641	39.4641	39.2811	39.8447	40.4522	40.8816	41.3305 (38)
Heat transfer coeff	108.4631	108.2167	107.9752	106.8406	106.6284	105.6402	105.6402	105.4573	106.0209	106.6284	107.0578	107.5067 (39)
Average = Sum(39)m / 12 =												106.8396 (39)
HLP	1.1951	1.1923	1.1897	1.1772	1.1748	1.1640	1.1640	1.1619	1.1681	1.1748	1.1796	1.1845 (40)
HLP (average)												1.1772 (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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.4850	102.6128	98.7406	94.8685	90.9963	87.1241	87.1241	90.9963	94.8685	98.7406	102.6128	106.4850 (44)
Energy content (annual)	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (46)
Water storage loss:												180.0000 (47)
Store volume												1.1100 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.5994 (55)
Total storage loss	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (56)
If cylinder contains dedicated solar storage	18.5814	16.7832	18.5814	17.9820	18.5814	17.9820	18.5814	18.5814	17.9820	18.5814	17.9820	18.5814 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	199.7580	175.9071	184.3638	164.7464	161.0669	143.3745	137.1777	151.2408	151.1976	170.8581	181.3232	194.7752 (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	199.7580	175.9071	184.3638	164.7464	161.0669	143.3745	137.1777	151.2408	151.1976	170.8581	181.3232	194.7752 (64)
Heat gains from water heating, kWh/month	85.9815	76.1580	80.8629	73.7091	73.1167	66.6030	65.1736	69.8496	69.2041	76.3723	79.2209	84.3247 (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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(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)	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)	115.5665	113.3304	108.6867	102.3738	98.2752	92.5041	87.5989	93.8838	96.1169	102.6510	110.0291	113.3397	(72)
Total internal gains	443.5139	440.9847	425.9165	401.8407	377.4005	354.1596	339.3374	345.9154	358.5730	382.8700	410.5897	431.3701	(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				4.7800	10.6334	0.4500		0.0000		0.7700	17.6118 (74)	
South				3.9800	46.7521	0.4500		0.0000		0.7700	64.4744 (78)	
Solar gains	82.0861	139.2494	191.6974	243.8851	282.1647	284.9305	272.6406	242.7848	209.2700	153.9556	98.1505	70.3938 (83)
Total gains	525.6001	580.2341	617.6140	645.7258	659.5651	639.0902	611.9779	588.7002	567.8431	536.8255	508.7402	501.7639 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.1099	58.2422	58.3725	58.9923	59.1098	59.6627	59.6627	59.7662	59.4485	59.1098	58.8727	58.6268
alpha	4.8740	4.8828	4.8915	4.9328	4.9407	4.9775	4.9775	4.9844	4.9632	4.9407	4.9248	4.9085
util living area	0.9983	0.9969	0.9936	0.9834	0.9510	0.8552	0.7020	0.7435	0.9183	0.9855	0.9967	0.9987 (86)
Tweekday	18.1648	18.3495	18.6676	19.1103	19.5361	19.8460	19.9336	19.9274	19.7526	19.2294	18.6281	18.1394
Tweekend	20.1463	20.2274	20.3677	20.5622	20.7573	20.9136	20.9765	20.9683	20.8599	20.6138	20.3472	20.1325
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.6825	19.8049	20.0242	20.3163	20.6255	20.8673	20.9637	20.9511	20.7813	20.4040	19.9807	19.6611 (87)
Th 2	19.9240	19.9261	19.9283	19.9383	19.9402	19.9489	19.9489	19.9506	19.9456	19.9402	19.9364	19.9324 (88)
util rest of house	0.9977	0.9958	0.9911	0.9761	0.9261	0.7776	0.5615	0.6100	0.8665	0.9777	0.9953	0.9982 (89)
Tweekday	18.1648	18.3495	18.6676	19.1103	19.5361	19.8460	19.9336	19.9274	19.7526	19.2294	18.6281	18.1394
Tweekend	18.1648	18.3495	18.6676	19.1103	19.5361	19.8460	19.9336	19.9274	19.7526	19.2294	18.6281	18.1394
MIT 2	18.1648	18.3495	18.6676	19.1103	19.5361	19.8460	19.9336	19.9274	19.7526	19.2294	18.6281	18.1394 (90)
Living area fraction	fLA = Living area / (4) =											0.2901 (91)
MIT	18.6051	18.7717	19.0612	19.4602	19.8521	20.1423	20.2325	20.2244	20.0511	19.5702	19.0205	18.5809 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6051	18.7717	19.0612	19.4602	19.8521	20.1423	20.2325	20.2244	20.0511	19.5702	19.0205	18.5809 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	523.8201	576.7883	610.3706	627.4537	609.0964	507.5945	368.7968	381.7933	495.6865	522.7970	505.4255	500.4094	(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	1551.5759	1501.1538	1356.2955	1128.2583	869.2501	585.4889	383.7334	403.3121	630.9364	956.4754	1276.1798	1546.0390	(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	764.6503	621.1736	554.9681	360.5793	193.5544	0.0000	0.0000	0.0000	0.0000	322.6567	554.9431	777.9484	(98)
Space heating												4150.4739	(98)
Space heating per m2												(98) / (4) =	45.7302 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													331.2378 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													1253.0192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	764.6503	621.1736	554.9681	360.5793	193.5544	0.0000	0.0000	0.0000	0.0000	322.6567	554.9431	777.9484	(98)
Space heating efficiency (main heating system 1)	331.2378	331.2378	331.2378	331.2378	331.2378	0.0000	0.0000	0.0000	0.0000	331.2378	331.2378	331.2378	(210)
Space heating fuel (main heating system)	230.8463	187.5310	167.5437	108.8581	58.4337	0.0000	0.0000	0.0000	0.0000	97.4094	167.5362	234.8610	(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	199.7580	175.9071	184.3638	164.7464	161.0669	143.3745	137.1777	151.2408	151.1976	170.8581	181.3232	194.7752	(64)
Efficiency of water heater (217)m	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	279.9650	(216)
Fuel for water heating, kWh/month	71.3511	62.8318	65.8524	58.8453	57.5311	51.2116	48.9982	54.0213	54.0059	61.0284	64.7664	69.5713	(217)
Water heating fuel used												720.0148	(219)
Annual totals kWh/year													
Space heating fuel - main system												1253.0192	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												440.4251	(232)
Total delivered energy for all uses												2413.4592	(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	1253.0192	0.5190	650.3170 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	720.0148	0.5190	373.6877 (264)
Space and water heating			1024.0047 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/year			1252.5853 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8000 (273)

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

DER		13.8000	ZC1
Total Floor Area	TFA	90.7600	
Assumed number of occupants	N	2.6360	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.7004	ZC2
CO2 emissions from cooking, equation (L16)		2.0082	ZC3
Total CO2 emissions		31.5086	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		31.5086	ZC8

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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	3.5700 (1b)	x 2.4000 (2b)	= 8.5680 (1b) - (3b)
First floor	87.1900 (1c)	x 2.4000 (2c)	= 209.2560 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	90.7600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 217.8240 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1377 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3877 (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) =	0.3296 (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	0.4202	0.4120	0.4037	0.3625	0.3543	0.3131	0.3131	0.3048	0.3296	0.3543	0.3708	0.3872 (22b)
Effective ac	0.5883	0.5849	0.5815	0.5657	0.5628	0.5490	0.5490	0.5465	0.5543	0.5628	0.5687	0.5750 (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			2.0600	1.0000	2.0600		(26)
TER Opening Type (Uw = 1.40)			8.7600	1.3258	11.6136		(27)
Heat Loss Floor 1			3.5700	0.1300	0.4641		(28a)
Heat Loss Floor 2			83.6200	0.1300	10.8706		(28a)
External Wall 1	117.8600	10.8200	107.0400	0.1800	19.2672		(29a)
External Roof 1	87.1900		87.1900	0.1300	11.3347		(30)
Total net area of external elements Aum(A, m ²)			292.2400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.6102		(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)							19.1748 (36)
Total fabric heat loss						(33) + (36) =	74.7850 (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	42.2869	42.0405	41.7990	40.6644	40.4522	39.4641	39.4641	39.2811	39.8447	40.4522	40.8816	41.3305 (38)
Heat transfer coeff	117.0720	116.8255	116.5840	115.4495	115.2372	114.2491	114.2491	114.0661	114.6297	115.2372	115.6666	116.1156 (39)
Average = Sum(39)m / 12 =												115.4485 (39)
HLP	1.2899	1.2872	1.2845	1.2720	1.2697	1.2588	1.2588	1.2568	1.2630	1.2697	1.2744	1.2794 (40)
HLP (average)												1.2720 (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												2.6360 (42)
Average daily hot water use (litres/day)												96.8045 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	106.4850	102.6128	98.7406	94.8685	90.9963	87.1241	87.1241	90.9963	94.8685	98.7406	102.6128	106.4850 (44)
Energy content (annual)	157.9142	138.1127	142.5200	124.2524	119.2231	102.8805	95.3339	109.3970	110.7036	129.0143	140.8292	152.9314 (45)
Distribution loss (46)m = 0.15 x (45)m	23.6871	20.7169	21.3780	18.6379	17.8835	15.4321	14.3001	16.4096	16.6055	19.3522	21.1244	22.9397 (46)
Water storage loss:												180.0000 (47)
Store volume												1.5520 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8381 (55)
Total storage loss												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(56)
If cylinder contains dedicated solar storage												
25.9803	23.4661	25.9803	25.1422	25.9803	25.1422	25.9803	25.9803	25.1422	25.9803	25.1422	25.9803	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
207.1568	182.5900	191.7627	171.9066	168.4658	150.5347	144.5766	158.6397	158.3578	178.2570	188.4834	202.1741	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
207.1568	182.5900	191.7627	171.9066	168.4658	150.5347	144.5766	158.6397	158.3578	178.2570	188.4834	202.1741	(64)
Heat gains from water heating, kWh/month												
91.9006	81.5043	86.7820	79.4373	79.0358	72.3311	71.0927	75.7686	74.9323	82.2914	84.9491	90.2438	(65)
Total per year (kWh/year) = Sum(64)m =												2102.9051 (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	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	131.7990	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
24.9387	22.1503	18.0139	13.6376	10.1943	8.6065	9.2996	12.0879	16.2244	20.6006	24.0440	25.6318	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
240.4690	242.9643	236.6762	223.2896	206.3913	190.5093	179.8992	177.4039	183.6920	197.0787	213.9769	229.8589	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	36.1799	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	-105.4392	(71)
Water heating gains (Table 5)												
123.5223	121.2861	116.6425	110.3295	106.2309	100.4599	95.5546	101.8396	104.0726	110.6067	117.9848	121.2955	(72)
Total internal gains												
454.4697	451.9405	436.8723	412.7965	388.3563	365.1154	350.2931	356.8711	369.5288	393.8257	421.5454	442.3259	(73)

6. Solar gains

[Jan]												
	Area	Solar flux	Specific data		FF	Access	Gains					
	m2	Table 6a	or Table 6b		or Table 6c	factor	W					
		W/m2				Table 6d						
North	4.7800	10.6334	0.6300		0.7000	0.7700	15.5336		(74)			
South	3.9800	46.7521	0.6300		0.7000	0.7700	56.8664		(78)			
Solar gains	72.4000	122.8180	169.0771	215.1067	248.8692	251.3087	240.4690	214.1362	184.5762	135.7888	86.5687	62.0874 (83)
Total gains	526.8697	574.7585	605.9494	627.9031	637.2255	616.4241	590.7621	571.0074	554.1050	529.6145	508.1142	504.4132 (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	53.8368	53.9503	54.0621	54.5934	54.6939	55.1670	55.2555	54.9838	54.6939	54.4909	54.2802	
alpha	4.5891	4.5967	4.6041	4.6396	4.6463	4.6778	4.6837	4.6656	4.6463	4.6327	4.6187	
util living area	0.9982	0.9970	0.9943	0.9864	0.9618	0.8862	0.7516	0.7875	0.9343	0.9873	0.9967	0.9986 (86)
MIT	19.5579	19.6797	19.9011	20.2129	20.5353	20.8124	20.9405	20.9238	20.7230	20.3159	19.8856	19.5371 (87)
Th 2	19.8487	19.8509	19.8530	19.8628	19.8647	19.8732	19.8732	19.8748	19.8699	19.8647	19.8609	19.8570 (88)
util rest of house	0.9976	0.9959	0.9920	0.9801	0.9406	0.8143	0.6035	0.6502	0.8878	0.9802	0.9953	0.9981 (89)
MIT 2	17.9353	18.1146	18.4393	18.8988	19.3582	19.7239	19.8473	19.8376	19.6183	19.0511	18.4230	17.9105 (90)
Living area fraction												
MIT	18.4060	18.5687	18.8634	19.2800	19.6997	20.0397	20.1644	20.1527	19.9388	19.4180	18.8473	18.3824 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4060	18.5687	18.8634	19.2800	19.6997	20.0397	20.1644	20.1527	19.9388	19.4180	18.8473	18.3824 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9964	0.9941	0.9892	0.9756	0.9366	0.8272	0.6466	0.6892	0.8915	0.9762	0.9934	0.9971	(94)	
Useful gains	524.9701	571.3916	599.3995	612.6022	596.8204	509.9191	381.9779	393.5559	493.9713	517.0161	504.7626	502.9301	(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														
Month fracti	1651.4163	1596.8492	1441.3716	1198.3647	921.8592	621.4767	407.2319	428.0553	669.2951	1016.1637	1358.7697	1646.7984	(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)	
	838.0759	689.1075	626.4273	421.7490	241.8288	0.0000	0.0000	0.0000	0.0000	371.3658	614.8851	851.0380	(98)	
Space heating												4654.4775	(98)	
Space heating per m2												(98) / (4) =	51.2834	(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 %)												93.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4978.0508 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	838.0759	689.1075	626.4273	421.7490	241.8288	0.0000	0.0000	0.0000	0.0000	371.3658	614.8851	851.0380 (98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000 (210)
Space heating fuel (main heating system)	896.3379	737.0134	669.9757	451.0685	258.6405	0.0000	0.0000	0.0000	0.0000	397.1826	657.6311	910.2011 (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	207.1568	182.5900	191.7627	171.9066	168.4658	150.5347	144.5766	158.6397	158.3578	178.2570	188.4834	202.1741 (64)
Efficiency of water heater (217)m	88.1573	88.0276	87.7426	87.1175	85.7775	79.8000	79.8000	79.8000	79.8000	86.7284	87.7398	79.8000 (216)
Fuel for water heating, kWh/month	234.9856	207.4235	218.5514	197.3274	196.3985	188.6399	181.1736	198.7966	198.4433	205.5347	214.8209	88.2291 (217)
Water heating fuel used												229.1468 (219)
Annual totals kWh/year												2471.2423 (219)
Space heating fuel - main system												4978.0508 (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)												440.4251 (232)
Total delivered energy for all uses												7964.7182 (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	4978.0508	0.2160	1075.2590 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2471.2423	0.2160	533.7883 (264)
Space and water heating			1609.0473 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.4251	0.5190	228.5806 (268)
Total CO2, kg/m2/year			1876.5529 (272)
Emissions per m2 for space and water heating			17.7286 (272a)
Fuel factor (electricity)			1.5500
Emissions per m2 for lighting			2.5185 (272b)
Emissions per m2 for pumps and fans			0.4289 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.7286 * 1.55) + 2.5185 + 0.4289, rounded to 2 d.p.			30.4300 (273)

APPENDIX B

Domestic

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	11.4	1.8
After energy demand reduction (be lean)	10.3	1.8
After heat network connection (be clean)	9.9	1.8
After renewable energy (be green)	7.3	1.8

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: savings from energy demand reduction	1.1	10%
Be clean: savings from heat network	0.4	3%
Be green: savings from renewable energy	2.6	23%
Cumulative on site savings	4.0	36%
Annual savings from off-set payment	7.3	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	219	-
Cash in-lieu contribution (£)	13,161	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

Table 1: Carbon Dioxide Emissions after each stage of the Energy Hierarchy for domestic buildings

	Carbon Dioxide Emissions for domestic buildings (Tonnes CO ₂ per annum)	
	Regulated	Unregulated
Baseline: Part L 2013 of the Building Regulations Compliant Development	10.2	-
After energy demand reduction (be lean)	9.1	-
After heat network connection (be clean)	8.8	-
After renewable energy (be green)	3.3	-

Table 2: Regulated Carbon Dioxide savings from each stage of the Energy Hierarchy for domestic buildings

	Regulated domestic carbon dioxide savings	
	(Tonnes CO ₂ per annum)	(%)
Be lean: Savings from energy demand reduction	1.1	10%
Be clean: Savings from heat network	0.3	3%
Be green: Savings from renewable energy	5.5	54%
Cumulative on site savings	6.9	68%
Annual savings from off-set payment	3.3	-
(Tonnes CO ₂)		
Cumulative savings for off-set payment	98	-
Cash in-lieu contribution (£)	5,908	

*carbon price is based on GLA recommended price of £95 per tonne of carbon dioxide unless Local Planning Authority price is inputted in the 'Development Information' tab

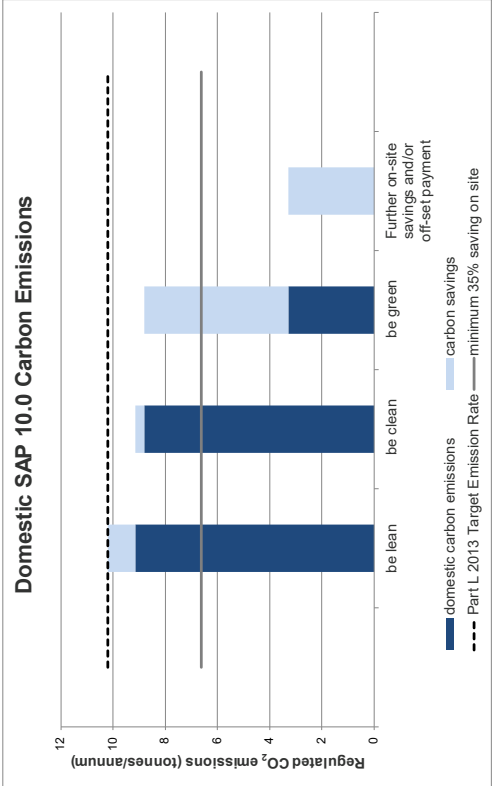
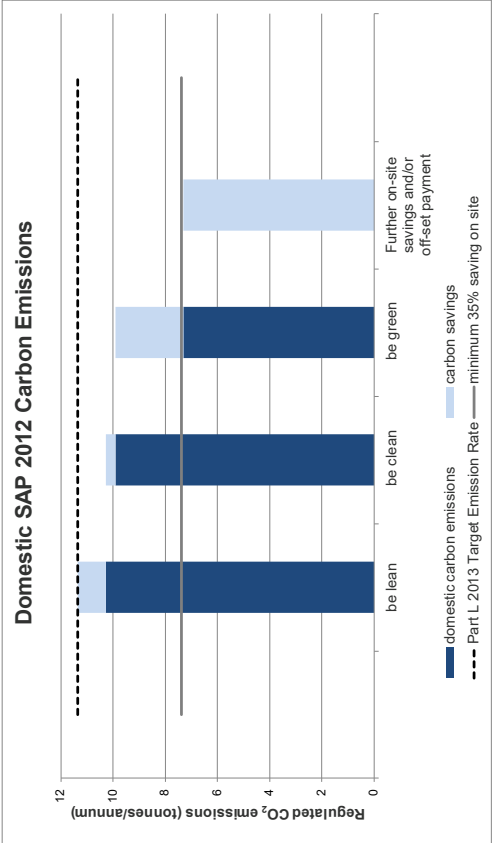
SITE-WIDE

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	11.4		
Be lean	10.3	1.1	10%
Be clean	9.9	0.4	3%
Be green	7.3	2.6	23%
Total Savings	-	4.0	36%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	219.3	-

	Total regulated emissions (Tonnes CO ₂ / year)	CO ₂ savings (Tonnes CO ₂ / year)	Percentage savings (%)
Part L 2013 baseline	10.2		
Be lean	9.1	1.1	10%
Be clean	8.8	0.3	3%
Be green	3.3	5.5	54%
Total Savings	-	6.9	68%
	-	CO ₂ savings off-set (Tonnes CO ₂)	-
Off-set	-	98.5	-

	Target Fabric Energy Efficiency (kWh/m ²)	Dwelling Fabric Energy Efficiency (kWh/m ²)	Improvement (%)
Development total	54.68	43.04	21%

	Area weighted non-domestic cooling demand (MJ/m ²)	Total area weighted non-domestic cooling demand (MJ/year)
Actual	9.936	0
Notional	11.988	0





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