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SUSTAINABILITY STATEMENT & ENERGY STRATEGY

3no. New Dwelling Houses at
Land to the rear of 2 Woodwell Cottages,
Woodwell Road,
Shirehampton, Bristol.

Presented to:

Hallen Developments Ltd

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ISSUE SHEET

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Completed By:	Jemma McLaughlan	Signed:	

[1] Bristol Development Framework Core Strategy. Adopted June 2011
[2] Bristol Climate Change and Sustainability Practice Note. July 2020

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[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

1. EXECUTIVE SUMMARY

This Energy & Sustainability Statement has been prepared to support the Planning Application for the proposed 3no. new dwelling houses to the reat of 2 Woodwell Cottages, Woodwell Road, Bristol.

The report will address the requirements of policies BCS13-BCS16 of the Bristol City Council Core Strategy[1], which relate to Climate Change, Sustainable Energy, Sustainable Design and Construction and Flood Risk and Water Management. The calculations and methodology used within this assessment and report structure, are in accordance with the Policy Guidance and the Bristol Climate Change and Sustainability Practice Note[2].

In order to establish predicted figures for the development, and to accurately assess the most feasible solution for the Energy & CO_2 Reduction Strategy, the property has been modelled using the governments Standard Assessment Procedure (SAP2012). In accordance with Bristol guidance, the current SAP2012 Carbon Emission factors have been used within the calculations and to demonstrate compliance with the policy requirements. However, as these are currently outdated, additional calculations have also been carried out based on the draft SAP10 Carbon Emission factors, which provide more accurate figures for us to consider within our calculations and report.

In accordance with the Energy Hierarchy, a baseline has been established which is based on mains Gas heating and hot water and is compliant with Parts L1A of the Building Regulations. After establishing this baseline, further Energy Efficiency measures are then incorporated prior to exploring a more energy efficient supply and renewable technologies.

As detailed in policy BCS14, the Heating and Hot Water system has been specified in accordance with the Heat Hierarchy following a feasible assessment, and the proposed Heating & Hot Water will be provided by efficient Gas Combination boilers supplemented by a 4.08kWp PV system. This will be 1.36kWp on each dwelling. (4no. 340W Panels).

A Summary of the Energy & CO2 reduction can be seen below:

ENERGY & CO^2 DEMAND REDUCTION SUMMARY				
	ENERGY demand (kWh pa)	ENERGY Saving (%)	CO2 demand (kg pa)	CO2 Saving (%)
BASELINE - Building Regulations Part L1A compliance	18783.8		4474.8	
BE LEAN – After further Energy Efficiency Measures	17236.7	8.2%	4108.9	8.2%
BE GREEN - After on-site Renewable or LZC Technologies	13991.5	18.8%	2424.6	41%
Scheme Offset or shortfall financial contribution				
TOTAL Savings		25.5%		45.8%

Above: Figure 1 – Energy & CO2 reduction Summary

The predicted annual saving in Energy from the PV array, following Energy Efficiency measures, has been calculated as 3245.2kWh. Based on SAP2012 Carbon Emission factors this equates to a 41% reduction in predicted regulated CO_2 with a 45.8% reduction overall.

A full breakdown of the energy demand and associated CO_2 can be seen in appendix A.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

2. INTRODUCTION

This Energy & Sustainability Statement has been prepared to support the Planning Application for the proposed 3no. new dwelling houses to the rear of 2 Woodwell Cottages, Woodwell Road, Bristol.

The report will address the requirements of policies BCS13-BCS16 of the Bristol City Council Core Strategy[1], which relate to Climate Change, Sustainable Energy, Sustainable Design and Construction and Flood Risk and Water Management. The calculations and methodology used within this assessment and report structure, are in accordance with the Policy Guidance and the Bristol Climate Change and Sustainability Practice Note[2].

In order to establish predicted figures for the development, and to accurately assess the most feasible solution for the Energy & CO^2 Reduction Strategy, the property has been modelled using the governments Standard Assessment Procedure (SAP2012). In accordance with Bristol guidance, the current SAP2012 Carbon Emission factors have been used within the calculations and to demonstrate compliance with the policy requirements. However, as these are currently outdated, additional calculations have also been carried out based on the draft SAP10 Carbon Emission factors, which provide more accurate figures for us to consider within our calculations and report.

We have worked with the design team and provided further consultancy to how the proposed development should address the issues of sustainability, resource efficiency and climate change, to reduce its overall environmental impact and demonstrate compliance with the relevant Bristol planning policy requirements and Part L of the Building Regulations.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

3. THE POLICY REQUIREMENTS

Bristol City Council is committed, through the Core Cities Climate Change Declaration and the Climate Change Act 2008, to an 80% reduction in CO^2 emissions by 2050. [1]

In order to achieve this goal, through its Planning Policies, Bristol Council have set out a holistic approach to promote and assess the Sustainability of new developments, through good design, resource efficiency and Carbon reduction.

The key requirements of the relevant policies of the Bristol City Council Core Strategy[1], which relate to Climate Change, Sustainable Energy, Sustainable Design and Construction and Flood Risk and Water Management are below:

Policy BSC13 Climate Change

Development should contribute to both mitigating and adapting to climate change, and to meeting targets to reduce carbon dioxide emissions.

Development should mitigate climate change through measures including:

- *High standards of energy efficiency including optimal levels of thermal insulation, passive ventilation and cooling, passive solar design, and the efficient use of natural resources in new buildings.*
- *The use of decentralised, renewable and low-carbon energy supply systems.*
- *Patterns of development which encourage walking, cycling and the use of public transport instead of journeys by private car.*

Development should adapt to climate change through measures including:

- *Site layouts and approaches to design and construction which provide resilience to climate change.*
- *Measures to conserve water supplies and minimise the risk and impact of flooding.*
- *The use of green infrastructure to minimise and mitigate the heating of the urban environment.*
- *Avoiding responses to climate impacts which lead to increases in energy use and carbon dioxide emissions.*

These measures should be integrated into the design of new development.

New development should demonstrate through Sustainability Statements how it would contribute to mitigating and adapting to climate change and to meeting targets to reduce carbon dioxide emissions by means of the above measures.

Policy BCS14

Proposals for the utilisation, distribution and development of renewable and low-carbon sources of energy, including large-scale freestanding installations, will be encouraged. In assessing such proposals the environmental and economic benefits of the proposed development will be afforded significant weight, alongside considerations of public health and safety and impacts on biodiversity, landscape character, the historic environment and the residential amenity of the surrounding area.

Development in Bristol should include measures to reduce carbon dioxide emissions from energy use in accordance with the following energy hierarchy:

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

1. Minimising energy requirements;
2. Incorporating renewable energy sources;
3. Incorporating low-carbon energy sources.

Consistent with stage two of the above energy hierarchy, development will be expected to provide sufficient renewable energy generation to reduce carbon dioxide emissions from residual energy use in the buildings by at least 20%. An exception will only be made in the case where a development is appropriate and necessary but where it is demonstrated that meeting the required standard would not be feasible or viable.
The use of combined heat and power (CHP), combined cooling, heat and power (CCHP) and district heating will be encouraged. Within Heat Priority Areas, major development will be expected to incorporate, where feasible, infrastructure for district heating, and will be expected to connect to existing systems where available.

New development will be expected to demonstrate that the heating and cooling systems have been selected according to the following heat hierarchy:

1. Connection to existing CHP/CCHP distribution networks
2. Site-wide renewable CHP/CCHP
3. Site-wide gas-fired CHP/CCHP
4. Site-wide renewable community heating/cooling
5. Site-wide gas-fired community heating/cooling
6. Individual building renewable heating

Policy BCS15
Sustainable design and construction will be integral to new development in Bristol. In delivering sustainable design and construction, development should address the following key issues:
- *Maximising energy efficiency and integrating the use of renewable and low-carbon energy;*
- *Waste and recycling during construction and in operation;*
- *Conserving water resources and minimising vulnerability to flooding;*
- *The type, life cycle and source of materials to be used;*
- *Flexibility and adaptability, allowing future modification of use or layout, facilitating future refurbishment and retrofitting;*
- *Opportunities to incorporate measures which enhance the biodiversity value of development, such as green roofs.*

New development will be required to demonstrate as part of the Sustainability Statement submitted with the planning application how the above issues have been addressed. For major development and development for health or education uses, the Sustainability Statement should include a BREEAM Additionally, in the case of a super-major development, a BREEAM for Communities assessment will be required. For non-residential development, from 2016, a BREEAM "Excellent" rating will be expected. All new development will be required to provide satisfactory arrangements for the storage of refuse and recyclable materials as an integral part of its design. Major developments should include communal facilities for waste collection and recycling where appropriate.
New homes and workplaces should include the provision of high-speed broadband access and enable provision of Next Generation broadband.
(References to Code for Sustainable Homes removed)

[1] Bristol Development Framework Core Strategy. Adopted June 2011
[2] Bristol Climate Change and Sustainability Practice Note. July 2020

Policy BCS16

Development in Bristol will follow a sequential approach to flood risk management, giving priority to the development of sites with the lowest risk of flooding. The development of sites with a sequentially greater risk of flooding will be considered where essential for regeneration or where necessary to meet the development requirements of the city.

Development in areas at risk of flooding will be expected to:

be resilient to flooding through design and layout, and/or

incorporate sensitively designed mitigation measures, which may take the form of on-site flood defence works and/or a contribution towards or a commitment to undertake such off-site measures as may be necessary, in order to ensure that the development remains safe from flooding over its lifetime.

All development will also be expected to incorporate water management measures to reduce surface water run-off and ensure that it does not increase flood risks elsewhere. This should include the use of sustainable drainage systems (SUDS).

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[2] Bristol Climate Change and Sustainability Practice Note. July 2020

4. DEVELOPMENT OVERVIEW

The application site is the land to the rear of no. 2 Woodwell Cottages, it is the second phase of the development, following the previous approval for 2no. dwellings adjacent.

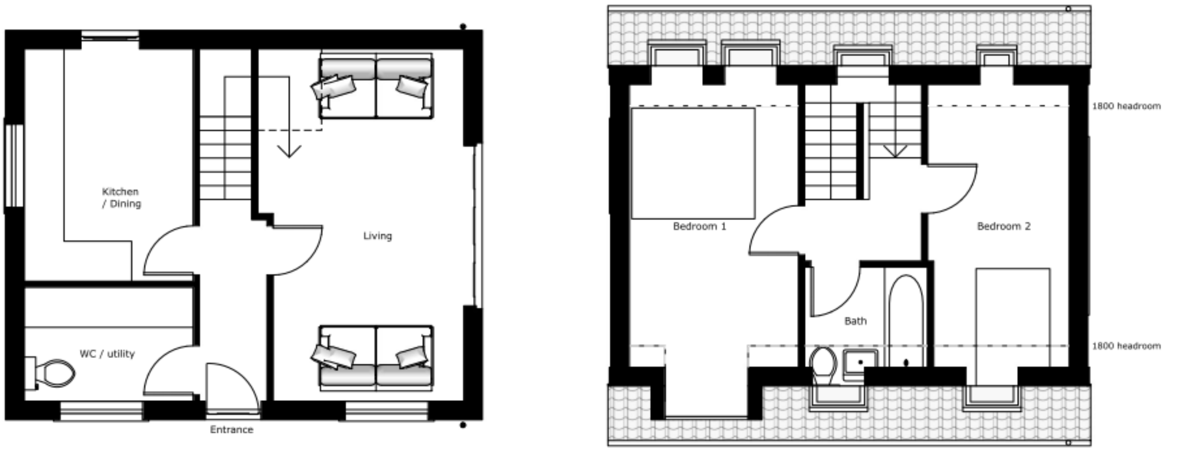
Above: Figure 1 – Site Location Plan

The site is already a residential plot and therefore supports the proposed use class, it is within easy reach of a variety of shops, restaurants and residential amenities, in addition to well defined public transport links.

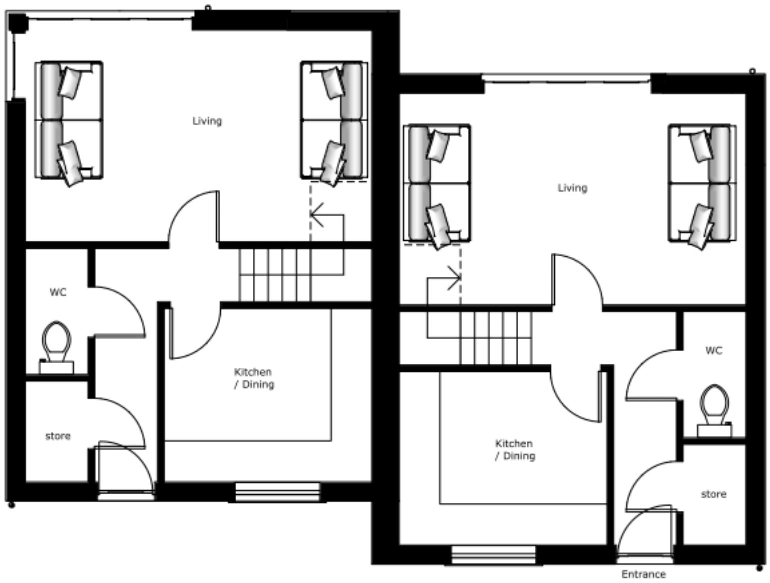
The SAP calculation have been based on the drawings by MLG architects.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

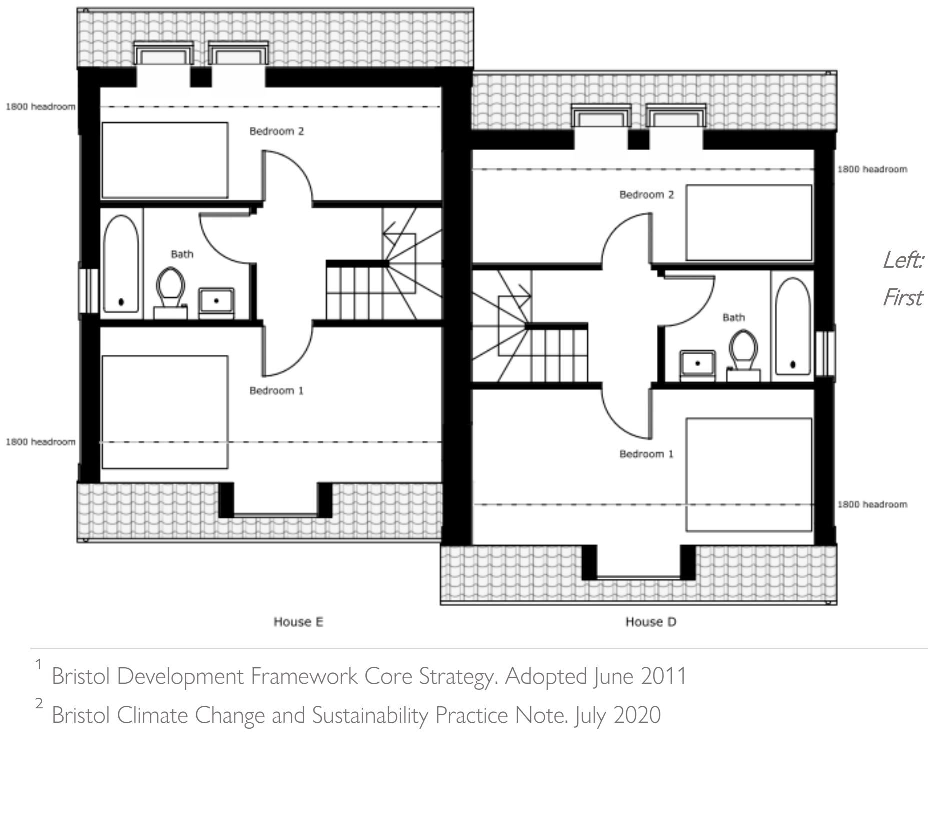
[2] Bristol Climate Change and Sustainability Practice Note. July 2020



Above: Figure 2 – House C Floor Plans



Left: Figure 3 – House D & E Ground Floor Plans



Left: Figure 4 – House D & E First floor Plans

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

5. ENERGY STRATEGY

To demonstrate compliance with Policies BSC13-16, a Sustainability Statement and compliant Energy Strategy should demonstrate how the development has taken a comprehensive approach to mitigating and adapting to climate change in accordance with the Energy and Heat Hierarchy.

In order to establish predicted figures for the development, and to accurately assess the most feasible solution for the Energy & CO^2 Reduction Strategy, the property has been modelled using the governments Standard Assessment Procedure (SAP2012).

In accordance with Bristol guidance, the current SAP2012 Carbon Emission factors have been used within the calculations and to demonstrate compliance with the policy requirements. As these are currently outdated, additional calculations have also been carried out based on the draft SAP10 Carbon Emission factors, which provide predicted figures for us to consider within our calculations and report.

Predicted energy demands & associated CO_2 have been shown in the following stages and tables, over a compliant Part L1A Baseline, in accordance with the Bristol Policies and the Bristol Climate Change and Sustainability Practice Note. The Full Energy Demand & CO_2 reduction spreadsheet can be seen in Appendix A.

BASELINE ENERGY DEMAND

In accordance with the Energy Hierarchy, a baseline has been established which is based on mains Gas heating and hot water with all fabric parameters and controlled fittings compliant with Parts L1A of the Building Regulations.

BASELINE Calculation		
	SAP 2012 - Current	SAP 10 - Predicted
Energy demand (kWh pa)	18783.8	18783.8
Regulated emissions (kg pa)	4474.8	3976.3

BASELINE Calculation Specification		
	Part L1A Limiting Fabric Parameters	BASELINE Fabric Parameters
Ground Floor U Value (W/m2K):	0.25	0.17
External Wall U Value (W/m2K):	0.30	0.24
Roof U Values (W/m2K):	0.20	0.15
Windows & Doors U Value (W/m2K):	2.0	1.4
Windows & Doors G Value:	-	0.6
Thermal Bridging	Use of ACDs and Thermal Lintels for lower Psi Values	
Air Permeability:	10	5.38
Ventilation:	Natural Ventilation with local extract	
Heating:	Wet Central Heating - Mains Gas Combi Boiler	
Hot Water:	Mains Gas Combi Boiler	
Lighting:	90% Low Energy Lighting	

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IMPROVED (BE LEAN) ENERGY DEMAND

After establishing this baseline, further Energy Efficiency measures are then specified to reduce the overall Energy demand. Designing with a 'fabric first' approach is the most sustainable and user effective way to improve and maximise energy efficiency and reduce carbon emissions for the dwelling over its lifetime. It involves improving the performance of the components and materials that make up the building fabric, before considering the use of mechanical or electrical building services systems and renewable/LZC technologies.

IMPROVED (BE LEAN) Calculation		
	SAP 2012 - Current	SAP 10 - Predicted
Energy Saving from EE measures (kWh pa)	1547.1	1547.1
Emissions Saving from EE measures (kg pa)	365.9	327.3
Regulated Emissions after EE measures (kg pa)	4108.9	3649
Emissions Saving from EE measures (%)	8.2%	8.2%

IMPROVED (BE LEAN) Calculation Specification		
	Part L1A Limiting Fabric Parameters	BASELINE Fabric Parameters
Ground Floor U Value (W/m2K):	0.25	0.17
External Wall U Value (W/m2K):	0.30	0.20
Roof U Values (W/m2K):	0.20	0.14
Windows & Doors U Value (W/m2K):	2.0	1.4 roof windows 1.3
Windows & Doors G Value:	-	0.6
Thermal Bridging	Use of ACDs and Thermal Lintels for lower Psi Values	
Air Permeability:	10	4
Ventilation:	Natural Ventilation with local extract	
Heating:	Wet Central Heating - Mains Gas Combi Boiler + Delayed Start Thermostat	
Hot Water:	Mains Gas Combi Boiler	
Lighting:	100% Low Energy Lighting	

FINAL (BE GREEN) ENERGY DEMAND & CARBON REDUCTION

The use of different Renewable and Low Zero Carbon technologies has been explored through the design development of this project and additional advice has been sought from Renewable Technology Suppliers to ensure that the chosen technology was feasible for the project. See section 6 for feasibility assessment.

FINAL (BE GREEN) Calculation		
	SAP 2012 - Current	SAP 10 - Predicted
Energy Saving from Renewable/LZC Tech (kWh pa)	3245.2	3245.2
Emissions Saving from Renewable/LZC Tech (kg pa)	1684.3	756.1
Regulated Emissions after Renewable/LZC Tech (kg pa)	2424.6	2892.9
Emissions Saving from Renewable/LZC Tech (%)	41%	20.7%

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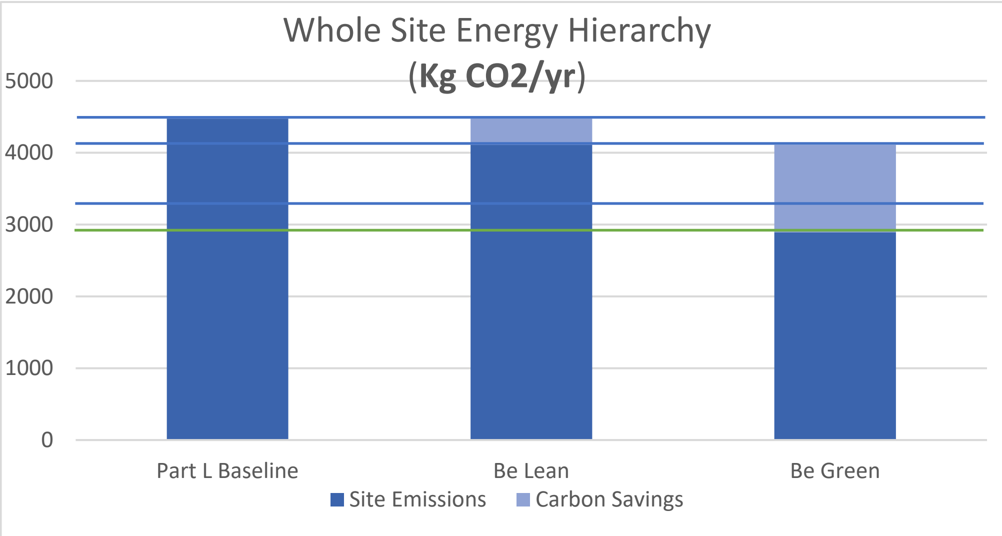
The target is to achieve at least a 20% reduction in predicted regulated CO_2 from the incorporation of on-site renewable technologies and the target has been exceeded.

We have increased the amount of PV to ensure the 20% reduction is also achieved based on the predicted SAP10 figures.



Baseline Emissions 4474.8kg

Improved Emissions 4108.9kg

Bristol Target 20% 3287.2kg

Final CO_2 (Green) 2892.9kg

A full breakdown of the energy demand and associated CO_2 savings can be seen in appendix A.

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[2] Bristol Climate Change and Sustainability Practice Note. July 2020

6. LZC TECHNOLOGY FEASIBILITY

The following different Renewable or Low Zero Carbon Technologies have been considered, and where deemed feasible for further consideration, have been assessed within SAP to obtain predicted regulated Energy demand figures, associated CO_2 emissions and fuel costs.

For the purposes of the feasibility assessment we have included Carbon Factors and Fuel Unit Prices from both the current SAP 2012 figures and the predicted SAP10 figures.

All savings are shown from the Renewable or LZC Technology only, over the stage 2 IMPROVED (BE LEAN) calculation with the exact same fabric specification. Where a Technology replaces the Gas Central heating system, the initial outlay cost is shown minus the cost of this system.

IMPROVED (BE LEAN) Calculation Specification		
	Part L1A Limiting Fabric Parameters	BASELINE Fabric Parameters
Ground Floor U Value (W/m2K):	0.25	0.17
External Wall U Value (W/m2K):	0.30	0.20
Roof U Values (W/m2K):	0.20	0.14
Windows & Doors U Value (W/m2K):	2.0	1.4 roof windows 1.3
Windows & Doors G Value:	-	0.6
Thermal Bridging	Use of ACDs and Thermal Lintels for lower Psi Values	
Air Permeability:	10	4
Ventilation:	Natural Ventilation with local extract	
Heating:	Wet Central Heating - Mains Gas Combi Boiler + Delayed Start Thermostat	
Hot Water:	Mains Gas Combi Boiler	
Lighting:	100% Low Energy Lighting	

IMPROVED (BE LEAN) Calculation		
Wet Central Heating & Hot Water Efficient Gas Combination Boiler	SAP 2012 Figures - Current	SAP 10 - Figures - Predicted
Regulated ENERGY Demand after EE measures (kWh pa)	17236.7	17236.7
Regulated CO2 Demand after EE measures (kg pa)	4108.9	3649.0
Total Energy Cost (SAP pa)	£1039.1	
Initial Cost Outlay	3.5K- 4.0K	
Predicted EPC Rating (relating to running costs)	B84	

The full Energy Demand, CO2 & Cost Analysis worksheets and SAP worksheets can be seen in the Appendices.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

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Biomass Heating

Biomass is any plant-derived organic material that renews itself over a short period.

Biomass energy systems are based on either the direct or indirect combustion of fuels derived from those plant sources. The most common form of biomass is the direct combustion of wood in treated or untreated forms. The use of biomass is becoming increasingly common in some European countries (some countries such as Austria are heavily dependent on biomass).

The environmental benefits relate to the significantly lower amounts of energy used in biomass production and processing compared to the energy released when they are burnt. This can range from a four-fold return for biodiesel to an approximate 20-fold energy return for woody biomass. Biomass-fuels can be used to produce energy on a continuous basis (unlike renewables such as wind or solar energy) and it can be an economic alternative to fossil fuels as it is a potential source of both heat and electricity.

Biomass systems have design management and maintenance requirements associated with sourcing, transportation and storage and are therefore more commonly used in commercial developments rather than domestic installations. It can be less convenient to operate than mains-supplied fuels such as natural gas and are more management intensive and require expertise in facilities management. Sources of biomass can also fluctuate, so boilers should be specified to operate on a variety of fuels without risk of overheating or tripping out.

Even a small biomass system would be impractical for these properties, the plot is on a residential street adjacent to other dwellings and housing the boilers, hoppers and fuel stores would take up a lot of space as well as being more difficult to facilitate and maintain for prospective buyers. There would likely be issues with accessible delivery and could be noise implications for neighbours. The system would also be quite a bit more expensive than other more suitable options and therefore this was not considered further.

Wind

Wind turbines convert the kinetic energy in wind into mechanical energy that is then converted to electricity. Turbines are available in a range of sizes and designs and can either be free-standing, mounted on a building or integrated into a building structure.

Wind generation would not be suitable for this property type and location. Average wind speed around this area is likely to be under 5m/s at 10m level, and the built-up residential area means that the wind would be turbulent.

Ground Source Heat pumps

A heat pump is a device that takes up heat at a certain temperature and releases it at a higher temperature. The essential components of a heat pump are heat exchangers (through which energy is extracted and emitted) and a means of pumping heat between the exchangers. The effectiveness of the heat pump is measured by the ratio of the heating capacity to the effective power input, usually known as the coefficient of performance (COP).

Ground-source heat pumps (GSHP) extract heat from the ground. They are classified as either water-to-air or water-to-water units depending on whether the heat distribution system in the building uses air or

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water. Ground source heat pumps either use long shallow trenches or deep vertical boreholes to take low grade heat from the ground and then compress it to create higher temperatures.

Ground Source Heat Pumps would not be suitable for this development, running the ground loops or boreholes for the 3 properties as well as the associated plant would require a lot of space and the ground work , initial outlay cost and additional requirements for plant and maintenance means that it would not be feasible.

Air Source Heat pumps

Air source heat pumps absorb heat from the outside air. This is usually used to heat radiators, underfloor heating systems, or warm air convectors. An air source heat pump extracts heat from the outside air in the same way that a fridge extracts heat from its inside.

The system performs down to air temperatures of -20°c which means that they are more than suitable for installations within the UK. Hot water and Heating can be provided 365 days a year. The hot water can be produced without the aid of electrical immersions and at around 50°c so is often boosted with electric immersion or a small buffer tank with heat exchangers at each shower to boost instantaneously at the source on demand.

There are two main types of air source heat pump system:

Air-to-air systems produce warm air which is circulated by fans. They are unlikely to provide you with hot water as well and are more common in non-domestic buildings such as offices. An air-to-water system distributes heat via a wet central heating system.

Air Source Heat Pump		
Saving from Renewable/LZC Technology Following Energy Efficiency Measures	SAP 2012 Figures - Current	SAP 10 - Figures - Predicted
Energy Saving from Renewable/LZC Tech (kWh pa)	8401.2	8401.2
Emissions Saving from Renewable/LZC Tech (kg pa)	0 (+476.7)	1590.3
Emissions Saving from Renewable/LZC Tech (%)	0 (+11.6)	43.6%
Initial Cost Outlay (Approx. Minus replaced Gas heating & hot water system)	15-19K	
FIT or RHI to consider	No	
Fuel Cost SAVING Per Annum	£0	
Fuel Cost INCREASE Per Annum	£935.7	
Payback (yrs)	None	
Predicted EPC Rating (relating to running costs)	C80	

Summary

This technology may be suitable for the properties, the system would be a split system with an indoor and outdoor unit. Technical advice would be need sought from a specialist supplier or Mechanical & Electrical consultant to confirm whether the technology would be suitable and provide further advice to

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whether they could be sited correctly for all dwellings where they would receive adequate unobstructed, clean airflow and shading from the sun in summer without causing any noise impact on the properties.

An ASHP wet central heating system will work better with underfloor heating, if radiators are used, they will heat to a lower temperature than with a Gas boiler and will usually have to be around double the size. A storage cylinder would also be required which wouldn't be required with the Gas Combi boiler.

The initial cost outlay would be more expensive than a Gas boiler and there will e no RHI. Compared with the Gas Combi boiler alone, without any renewables, running costs would be much higher for the occupant and the predicted EPC rating is lower.

This option does not meet the planning policy requirement of 20% reduction in CO_2 under current SAP 2012 calculations and has increased emissions of 476.7 kg/annum. It would meet the requirement based on future predicted figures.

Solar Hot Water (Thermal)

Solar water heating systems are one of the more familiar renewable technologies used, they use the energy from the sun to heat water. Solar heating systems use a heat collector that is usually mounted on a roof in which a fluid is heated by the sun. This fluid is used to heat water that is stored in either a separate hot water cylinder or in a twin-coil hot water cylinder, the second coil is used to provide additional heating from a boiler or other heat source.

Solar Hot Water Panels could be mounted onto the roof space to supplement a mains Gas Combi boiler. They were considered along with other technologies based on a 4.8m2 Evacuated Tube System on each dwelling and the results are as follows:

Solar Hot Water Panels		
Saving from Renewable/LZC Technology Following Energy Efficiency Measures	SAP 2012 Figures - Current	SAP 10 - Figures - Predicted
Energy Saving from Renewable/LZC Tech (kWh pa)	2063.6	2063.6
Emissions Saving from Renewable/LZC Tech (kg pa)	400.3	429.9
Emissions Saving from Renewable/LZC Tech (%)	9.7%	11.8%
Initial Cost Outlay	9.5k-10.5k	
FIT or RHI to consider	No	
Fuel Cost SAVING Per Annum	£54.1	
Fuel Cost INCREASE Per Annum	£0	
Payback (yrs)	175	
Predicted EPC Rating (relating to running costs)	B85	

Summary

This technology would be feasible for the project, the Solar Hot Water system could be installed along with an efficient Gas boiler, the downside is that a storage cylinder would also be required, which isn't required with the Gas Combi Boiler, so additional indoor space would be required.

Future occupiers would benefit from a very small saving in running costs.

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This option does not meet the planning policy requirement of 20% reduction in CO2 using either current or predicted carbon factors.

Photovoltaic (PV) Panels

Photovoltaic (PV) modules convert sunlight directly to DC electricity.

A PV system could be mounted onto the roof space to supplement a mains Gas Combi boiler wet central heating system to generate electricity, and therefore reduce grid supplied electricity and running costs. Battery storage can now also be added to minimise the reliance on the grid even further.

There are many renewable energy suppliers and whilst this cannot be factored into the SAP calculations for consistency and comparability, this is another good way to reduce your Carbon Emissions.

The PV amount has been increased to meet the 20% target on predicted figures, the results are as follows:

PV – 4.08kWp System – 1.36kWp on 3no. Dwellings		
Saving from Renewable/LZC Technology Following Energy Efficiency Measures	SAP 2012 Figures - Current	SAP 10 - Figures - Predicted
Energy Saving from Renewable/LZC Tech (kWh pa)	3245.2	3245.2
Emissions Saving from Renewable/LZC Tech (kg pa)	1684.3	756.1
Emissions Saving from Renewable/LZC Tech (%)	41%	20.7%
Initial Cost Outlay	8-9K	
FIT or RHI to consider	No	
Fuel Cost SAVING Per Annum	£461.4	
Fuel Cost INCREASE Per Annum	£0	
Payback (yrs)	17	
Predicted EPC Rating (relating to running costs)	B90	

Summary

The 4.08kWp PV system has been chosen for the project, the PV system would be installed along with an efficient Gas Combination boiler wet central heating system and when comparing all factors within the feasibility assessment, this is deemed the best option for the project.

The installation will be the easiest and cheapest option for the builder and even without FIT payments, this option provides good selling points to prospective buyers who will have a familiar heating and hot water system that will be easy to use and simple and cheap to maintain. With a high EPC rating and Electricity generated by the PV, the occupier will benefit from the lower running costs and the system will pay back in a reasonably short period of time. The amount of PV proposed means that the 20% reduction in CO2 is achieved on both current and predicted carbon factors.

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7. SUSTAINABILITY STATEMENT

This report demonstrates that the policy requirements have been considered throughout the early design stages of this development. Improvements will be incorporated throughout the Design & Construction, to ensure that the scheme will perform above the minimum standards of Part L of the Building Regulations.

The site is in a good location in an already establish residential area and therefore supports the proposed use class. The new dwelling is within easy reach of a variety of shops, restaurants and residential amenities, in addition to well defined public transport links.

The following section summarises the measures taken to create a holistically sustainable development.

Designing for Climate Change adaption, mitigation & Energy Efficiency

A fabric first design approach will mean that insulation standards including glazing, and air-tightness, will exceed current Building Regulations Part L standards. Improved air tightness and good U Values, will also limit heat losses and gains, reduce heating and cooling requirements and therefore associated running costs and C02.

To help manage and promote energy efficiency from occupant use Low Energy Lighting is specified, where supplied, white goods will be energy efficient (A+ or A rated) and smart meters will be provided to assist occupants with Energy management. A building user guide will also be provided to educate the occupants and encourage them to use the building and its services and appliances properly and efficiently. Sanitaryware and white goods will also be specified with Low water usage and if required flow restrictors to minimise water use.

It is proposed that the Heating and Hot water will be via efficient Gas Combi boilers supplemented by a 4.08kWp PV system, which will be split as 1.36kWp (4no. 340WPanels) on each dwelling, mounted on the rear east facing roof on house C, and the South facing roof for house D & E. Following the feasibility assessment and all areas being considered, this was deemed to be the best option for the project, it is the easiest and cheapest system to install, with no additional space required internally or externally for condensers or water storage cylinder, it would familiar and easy to maintain by the occupant as well as being the lowest on running costs with the shortest payback period and it achieves the 20% target on both current and predicted figures.

Materials

Consideration will be given to using materials and construction that have a low environmental impact, such as those achieving an A+ or A rated under BRE's Green Guide. Where possible, materials will be chosen that are local and responsibly sourced (such as FSC timber), recycled or reclaimed. All insulation materials will have a GWP (Global Warming Potential) of 5 or less.

Waste

The contractor will produce a Site Waste Management Plan (SWMP) to set targets and monitor to reduce waste and divert from landfill. The dwelling will incorporate dedicated internal and external general waste and recyclable storage in accordance with the LA collection.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

Health & Wellbeing

Rooms will have good levels of day lighting, and décor will enhance this so to reduce the need for artificial lighting. Materials with low VOC emissions will be used. Gardens are provided so that the occupants have access to private outdoor space.

Transport

Parking is provided outside the dwellings and there are excellent public transport links nearby and amenities are within walking distance. Cycle storage will also be provided.

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

APPENDICES:

A: Energy Demand Assessment Work Sheets

B: SAP Calculation Worksheets - BASELINE

C: SAP Calculation Worksheets – IMPROVED (BE LEAN)

D: SAP Calculation Worksheets – FINAL (BE GREEN)

E: Predicted EPCs

F: Feasibility Work Sheets

[1] Bristol Development Framework Core Strategy. Adopted June 2011

[2] Bristol Climate Change and Sustainability Practice Note. July 2020

APPENDIX A: Energy Demand Assessment Work Sheets

SITE WIDE ENERGY DEMAND, CO2 & COST ANALYSIS - WOODWELL P2

OPTION 1 - PV	HOUSE C	HOUSE D	HOUSE E	SITE TOTAL	CURRENT CARBON FACTORS - SAP 2012		PREDICTED CARBON FACTORS - SAP 10	
Stage 1 - BASELINE Energy Demand	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1825.6	1800.4	1800.4	5426.3	0.216	1172.1	0.210	1139.5
Space Heating (211)	4195.5	3892.0	3892.0	11979.4	0.216	2587.6	0.210	2515.7
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	385.4	383.8	383.8	1153.0	0.519	598.4	0.233	268.7
TOTAL	**6481.5**	**6151.2**	**6151.2**	**18783.8**		**4474.8**		**3976.3**
Stage 2 - IMPROVED Energy Demand Following Energy Efficiency Measures	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1827.2	1801.4	1801.4	5430.0	0.216	1172.9	0.210	1140.3
Space Heating (211)	3574.5	3479.5	3479.5	10533.5	0.216	2275.2	0.210	2212.0
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
TOTAL	**5827.1**	**5704.8**	**5704.8**	**17236.7**		**4108.9**		**3649.0**
Stage 3 - FINAL Energy Demand following Renewable or LZC Technologies	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1827.2	1801.4	1801.4	5430.0	0.216	1172.9	0.210	1140.3
Space Heating (211)	3574.5	3479.5	3479.5	10533.5	0.216	2275.2	0.210	2212.0
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
PV	-921.1	-1162.1	-1162.1	-3245.2	0.519	-1684.3	0.233	-756.1
TOTAL	**4906.0**	**4542.7**	**4542.7**	**13991.5**		**2424.6**		**2892.9**

CO^2 REDUCTION SUMMARY - SAP2012

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	4474.8
Improved emissions after application of energy efficiency measures.	4108.9
CO2 Reduction from application of energy efficiency measures.	365.9
Improved emissions after incorporation of efficient energy supply	4108.9
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	2424.6
CO2 Reduction from incorporation of renewable energy	1684.3
CO2 displaced in total	**2050.2**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**41.0%**
% CO2 displaced in total	**45.8%**

ENERGY REDUCTION SUMMARY - SAP2012

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	13991.5
Energy Saved from incorporation of renewable energy technology.	3245.2
Energy Demand reduction in total	**4792.3**
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	**18.8%**
% Energy Demand reduction in total	**25.5%**

CO^2 REDUCTION SUMMARY - SAP10

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	3976.3
Improved emissions after application of energy efficiency measures.	3649.0
CO2 Reduction from application of energy efficiency measures.	327.3
Improved emissions after incorporation of efficient energy supply	3649.0
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	2892.9
CO2 Reduction from incorporation of renewable energy	756.1
CO2 displaced in total	**1083.4**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**20.7%**
% CO2 displaced in total	**27.2%**

ENERGY REDUCTION SUMMARY - SAP10

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	13991.5
Energy Saved from incorporation of renewable energy technology.	3245.2
Energy Demand reduction in total	**4792.3**
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	**18.8%**
% Energy Demand reduction in total	**25.5%**

PROJECT KEY RESULTS

Reference	Property Type	SAP	EI	DER	TER
HOUSE C - BASELINE	House	B 83 (83.3123514001231)	85.7	18.89	18.9
HOUSE D - BASELINE	House	B 83 (83.4923581800995)	86.1	18.72	18.7
HOUSE E - BASELINE	House	B 83 (83.4923581800995)	86.1	18.72	18.7
HOUSE C - IMPROVED	House	B 84 (84.4508318813645)	87.2	17.03	18.9
HOUSE D - IMPROVED	House	B 84 (84.3359566261234)	87.2	17.36	18.7
HOUSE E - IMPROVED	House	B 84 (84.3359566261234)	87.2	17.36	18.7
HOUSE C - FINAL	House	B 90 (90.1206729781524)	92.3	11.11	18.9
HOUSE D - FINAL	House	B 90 (89.7940780831301)	92.1	11.59	18.7
HOUSE E - FINAL	House	A 92 (91.6134524117822)	93.8	9.66	18.7
HOUSE C - FINAL ASHP	House	C 80 (80.2899632511737)	82.3	22.5	27.6
HOUSE D - FINAL ASHP	House	C 80 (80.3148443202348)	82.3	22.89	27.2
HOUSE E - FINAL ASHP	House	C 80 (80.3148443202348)	82.3	22.89	27.2
HOUSE C - FINAL SHW	House	B 85 (85.2682356078918)	88.5	15.43	18.9
HOUSE D - FINAL SHW	House	B 85 (85.2069046419929)	88.6	15.63	18.7
HOUSE E - FINAL SHW	House	B 85 (85.2069046419929)	88.6	15.63	18.7

PROJECT KEY RESULTS

DFEE	TFEE	Percent Improvement	Total Floor Area	Main Heating Fuel Requirement (DER)	Secondary Main Heating Fuel Requirement (DER)	Secondary Heating Fuel Requirement (DER)	Water Fuel Requirement (DER)
54.3	57.0	0.05	81.5	4195.45	0.0	0	1825.6
50	53.0	0	78.4	3891.98	0.0	0	1800.4
50	53.0	0	78.4	3891.98	0.0	0	1800.4
48.2	57.0	9.89	81.5	3574.49	0.0	0	1827.2
46	53.0	7.26	78.4	3479.49	0.0	0	1801.4
46	53.0	7.26	78.4	3479.49	0.0	0	1801.4
48.2	57.0	41.22	81.5	3574.49	0.0	0	1827.2
46	53.0	38.09	78.4	3479.49	0.0	0	1801.4
46	53.0	48.4	78.4	3479.49	0.0	0	1801.4
48.2	57.0	18.48	81.5	1287.07	0.0	0	1354.1
46	53.0	15.81	78.4	1233.2	0.0	0	1339.9
46	53.0	15.81	78.4	1233.2	0.0	0	1339.9
48.2	57.0	18.23	81.5	3485.04	0.0	0	1194.7
46	53.0	16.24	78.4	3355.8	0.0	0	1179.3
46	53.0	16.24	78.4	3355.8	0.0	0	1179.3

PROJECT KEY RESULTS

Electricity Pumps Fans Requirement (DER)	Electricity Lighting Requirement (DER)	PV Energy Produced (DER)	Wind Energy Produced (DER)	Total CO2 (DER)	HLP	PV Kwp	Total Energy Cost
75	385.4	0	0.0	1539.51	1.5	0	379.7
75	383.8	0	0.0	1467.67	1.3	0	365.3
75	383.8	0	0.0	1467.67	1.3	0	365.3
75	350.4	0	0.0	1387.55	1.4	0	350.9
75	348.9	0	0.0	1360.68	1.2	0	344.1
75	348.9	0	0.0	1360.68	1.2	0	344.1
75	350.4	-928.1	0.0	905.86	1.4	1.360000014	175.5
75	348.9	-871.55	0.0	908.35	1.2	1.019999981	179.4
75	348.9	-1162.06	0.0	757.57	1.2	1.360000014	124.5
0	350.4	0	0.0	1833.77	1.4	0	609.8
0	348.9	0	0.0	1794.55	1.2	0	594.1
0	348.9	0	0.0	1794.55	1.2	0	594.1
125	350.4	0	0.0	1257.56	1.4	0	333.4
125	348.9	0	0.0	1225.54	1.2	0	325.8
125	348.9	0	0.0	1225.54	1.2	0	325.8

APPENDIX B: SAP Calculation Worksheets - BASELINE

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:05:09

Project Information:

Assessed By: Jemma Mclaughlan (STRO030065) **Building Type:** Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 81.5m²

Site Reference : WOODWELL **Plot Reference:** HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

Client Details:

Name:

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.9 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.89 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	54.3 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	**OK**
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.38 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 472, product index 017179):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi)
Efficiency 89.0 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	90.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: West	4.86m²
Windows facing: North	1.62m²
Windows facing: South	6.08m²
Windows facing: East	2.14m²
Roof windows facing: West	2.66m²
Roof windows facing: East	2.66m²
Roof windows facing: East	1.1m²
Roof windows facing: East	0.78m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

None

Thermal Bridge Report

Property Details: HOUSE C - BASELINE

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0724

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.3	9.97	E2	[A]
Sill	0.04	5.4	E3	[A]
Jamb	0.05	22.8	E4	[A]
Ground floor (normal)	0.1	25.7	E5	[UD]
Intermediate floor within a dwelling	0.07	25.7	E6	[A]
Eaves (insulation at rafter level)	0.04	15.65	E11	[A]
Gable (insulation at rafter level)	0.04	19.28	E13	[A]
Corner (normal)	0.09	15.8	E16	[A]

Roof Junctions Details:

Head	0.08	9.47	R1	[D]
Sill	0.06	9.47	R2	[D]
Jamb	0.08	17.2	R3	[D]
Ridge (vaulted ceiling)	0.08	9.3	R4	[D]

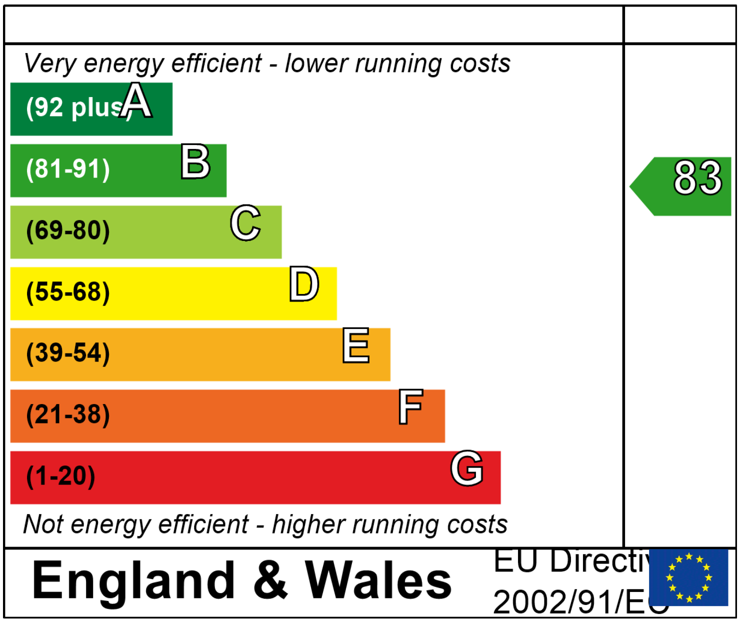
Predicted Energy Assessment

Woodwell Cottage P2	Dwelling type:	Detached House
Woodwell Road	Date of assessment:	24 February 2021
BRISTOL	Produced by:	Jemma Mclaughlan
BS11 9XU	Total floor area:	81.5 m²

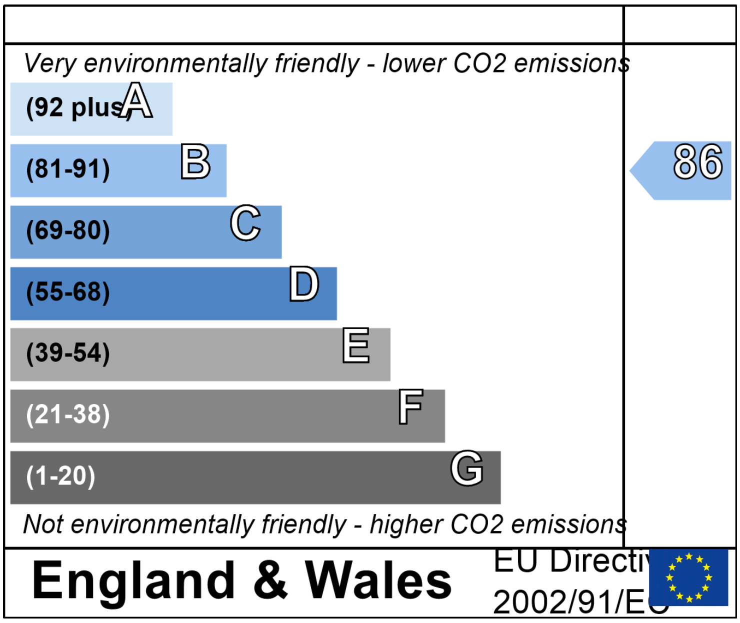
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE C - BASELINE

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House	
Detachment:	Detached	
Year Completed:	2021	
Floor Location:	Floor area:	Storey height:
Floor 0	40.75 m²	2.6 m
Floor 1	40.75 m²	2.24 m
Living area:	18.3 m² (fraction 0.225)	
Front of dwelling faces:	West	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-3 FRONT	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - SIDE S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W6 - REAR E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 FRONT W	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW3-4 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW5 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW6 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	1.93	1
W1-3 FRONT	16mm or more	0.8	0.63	1.4	1.62	3
W4 - SIDE N	16mm or more	0.8	0.63	1.4	1.62	1
W5 - SIDE S	16mm or more	0.8	0.63	1.4	6.08	1
W6 - REAR E	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 FRONT W	16mm or more	0.8	0.63	1.4	1.33	2
RW3-4 REAR E	16mm or more	0.8	0.63	1.4	1.33	2
RW5 REAR E	16mm or more	0.8	0.63	1.4	1.1	1
RW6 REAR E	16mm or more	0.8	0.63	1.4	0.78	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	West	0	0
W1-3 FRONT		EXTERNAL WALLS	West	0	0
W4 - SIDE N		EXTERNAL WALLS	North	0	0
W5 - SIDE S		EXTERNAL WALLS	South	0	0
W6 - REAR E		EXTERNAL WALLS	East	0	0
RW1-2 FRONT W		ROOF	West	0.001	0

SAP Input

RW3-4 REAR E	ROOF	East	0.001	0
RW5 REAR E	ROOF	East	0.001	0
RW6 REAR E	ROOF	East	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	102.95	16.63	86.32	0.24	0	False	N/A
DORMER CHEEKS	2	0	2	0.24	0	False	N/A
ROOF	61.3	7.2	54.1	0.15	0		N/A
GROUND FLOOR	40.75			0.17			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0724

	Length	Psi-value		
[Approved]	9.97	0.3	E2	Other lintels (including other steel lintels)
[Approved]	5.4	0.04	E3	Sill
[Approved]	22.8	0.05	E4	Jamb
	25.7	0.1	E5	Ground floor (normal)
[Approved]	25.7	0.07	E6	Intermediate floor within a dwelling
[Approved]	15.65	0.04	E11	Eaves (insulation at rafter level)
[Approved]	19.28	0.04	E13	Gable (insulation at rafter level)
[Approved]	15.8	0.09	E16	Corner (normal)
	9.47	0.08	R1	Head
	9.47	0.06	R2	Sill
	17.2	0.08	R3	Jamb
	9.3	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	5.38

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open

SAP Input

	Boiler interlock: Yes
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False
Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	90%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.42	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.54	0.53	0.52	0.46	0.45	0.4	0.4	0.39	0.42	0.45	0.47	0.49

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Rooflights Type 2			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Rooflights Type 3			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 4			0.78	x1/[1/(1.4) + 0.04]		=	1.092			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.24	=	20.72			(29)
Walls Type2	2	0	2	x	0.24	=	0.48			(29)
Roof	61.3	7.2	54.1	x	0.15	=	8.12			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 67.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 14.98 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 82.96 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.92	41.56	41.2	39.53	39.21	37.75	37.75	37.48	38.31	39.21	39.85	40.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.88	124.52	124.16	122.48	122.17	120.71	120.71	120.44	121.27	122.17	122.8	123.47

Average = Sum(39)$_{1…12}$ /12= | 122.48 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.53	1.53	1.52	1.5	1.5	1.48	1.48	1.48	1.49	1.5	1.51	1.51

Average = Sum(40)$_{1…12}$ /12= | 1.5 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)$_{1…12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)$_{1…12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ | 1617.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	54.56	48.46	39.41	29.84	22.3	18.83	20.35	26.45	35.5	45.07	52.6	56.08	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	332.16	335.61	326.92	308.43	285.09	263.15	248.49	245.05	253.73	272.22	295.57	317.5	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	564.27	559.46	537.25	503.1	468.27	437.29	419.42	428.14	448.03	482.39	520.38	548.99	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	7.81	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	14.93	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	25.37	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	40.76	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	54.9	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	58.78	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	54.87	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	43.54	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	30.51	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	17.78	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	9.64	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	6.51	(74)
East	0.9x	1	x	2.14	x	19.64	x	0.63	x	0.8	=	19.06	(76)
East	0.9x	1	x	2.14	x	38.42	x	0.63	x	0.8	=	37.29	(76)
East	0.9x	1	x	2.14	x	63.27	x	0.63	x	0.8	=	61.42	(76)
East	0.9x	1	x	2.14	x	92.28	x	0.63	x	0.8	=	89.58	(76)
East	0.9x	1	x	2.14	x	113.09	x	0.63	x	0.8	=	109.78	(76)
East	0.9x	1	x	2.14	x	115.77	x	0.63	x	0.8	=	112.38	(76)
East	0.9x	1	x	2.14	x	110.22	x	0.63	x	0.8	=	106.99	(76)
East	0.9x	1	x	2.14	x	94.68	x	0.63	x	0.8	=	91.9	(76)
East	0.9x	1	x	2.14	x	73.59	x	0.63	x	0.8	=	71.43	(76)
East	0.9x	1	x	2.14	x	45.59	x	0.63	x	0.8	=	44.25	(76)
East	0.9x	1	x	2.14	x	24.49	x	0.63	x	0.8	=	23.77	(76)
East	0.9x	1	x	2.14	x	16.15	x	0.63	x	0.8	=	15.68	(76)
South	0.9x	1	x	6.08	x	46.75	x	0.63	x	0.8	=	128.94	(78)
South	0.9x	1	x	6.08	x	76.57	x	0.63	x	0.8	=	211.17	(78)
South	0.9x	1	x	6.08	x	97.53	x	0.63	x	0.8	=	268.99	(78)
South	0.9x	1	x	6.08	x	110.23	x	0.63	x	0.8	=	304.01	(78)
South	0.9x	1	x	6.08	x	114.87	x	0.63	x	0.8	=	316.8	(78)
South	0.9x	1	x	6.08	x	110.55	x	0.63	x	0.8	=	304.88	(78)
South	0.9x	1	x	6.08	x	108.01	x	0.63	x	0.8	=	297.88	(78)
South	0.9x	1	x	6.08	x	104.89	x	0.63	x	0.8	=	289.29	(78)
South	0.9x	1	x	6.08	x	101.89	x	0.63	x	0.8	=	280.99	(78)
South	0.9x	1	x	6.08	x	82.59	x	0.63	x	0.8	=	227.76	(78)
South	0.9x	1	x	6.08	x	55.42	x	0.63	x	0.8	=	152.83	(78)
South	0.9x	1	x	6.08	x	40.4	x	0.63	x	0.8	=	111.41	(78)

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West	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.8	=	43.3	(80)
West	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.8	=	84.7	(80)
West	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.8	=	139.49	(80)
West	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.8	=	203.43	(80)
West	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.8	=	249.31	(80)
West	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.8	=	255.22	(80)
West	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.8	=	242.98	(80)
West	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.8	=	208.71	(80)
West	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.8	=	162.23	(80)
West	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.8	=	100.5	(80)
West	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.8	=	53.99	(80)
West	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.8	=	35.61	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.79	517.51	783.91	1074.27	1279.79	1299.53	1241.16	1086.49	885.88	593.84	346.49	238.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	848.07	1076.98	1321.16	1577.37	1748.06	1736.82	1660.59	1514.63	1333.91	1076.23	866.87	787.41	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.9	0.78	0.61	0.44	0.32	0.36	0.59	0.86	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.95	20.35	20.72	20.92	20.98	21	20.99	20.95	20.63	20.06	19.6	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.67	19.67	19.69	19.69	19.7	19.7	19.7	19.7	19.69	19.68	19.68	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.95	0.88	0.73	0.53	0.35	0.23	0.26	0.49	0.82	0.96	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.95	18.38	18.92	19.41	19.62	19.69	19.7	19.7	19.66	19.32	18.55	17.88	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.33	18.73	19.24	19.7	19.91	19.98	19.99	19.99	19.95	19.61	18.89	18.26	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.33	18.73	19.24	19.7	19.91	19.98	19.99	19.99	19.95	19.61	18.89	18.26	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.94	0.87	0.73	0.55	0.37	0.25	0.28	0.51	0.81	0.95	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	823.78	1009.8	1144.67	1146.87	956.36	642.64	408.44	430.91	683.69	874.53	820.32	769.68	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1751.93	1722.13	1581.45	1323.14	1003.3	649.73	409.4	432.66	709.49	1101.23	1447.46	1736.5	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	690.55	478.68	324.96	126.92	34.93	0	0	0	0	168.66	451.55	719.32	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2995.56 (98)

Space heating requirement in kWh/m²/year 36.76 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	690.55	478.68	324.96	126.92	34.93	0	0	0	0	168.66	451.55	719.32		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	768.13	532.46	361.47	141.18	38.85	0	0	0	0	187.61	502.27	800.13		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3332.11	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12		
Efficiency of water heater													87.3	(216)
(217)m=	89.39	89.28	89.06	88.56	87.85	87.3	87.3	87.3	87.3	88.72	89.24	89.42		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	184.51	161.97	168.51	149.12	145.27	127.66	119.79	135.32	136.3	154.49	165.89	179.08		
Total = Sum(219a)$_{1...12}$ =													1827.91	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3332.11

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Water heating fuel used			1827.91	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			385.42	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5707.74	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	115.96	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	63.61	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)
(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a					
Energy for lighting	(232)	13.19	x 0.01 =	50.84	(250)
Additional standing charges (Table 12)				120	(251)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			360.3	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.2	(257)
SAP rating (Section 12)		83.31	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	719.73	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	394.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1114.56	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.03	(268)
Total CO2, kg/year		sum of (265)…(271) =		1353.52	(272)
CO2 emissions per m²		(272) ÷ (4) =		16.61	(273)
El rating (section 14)				86	(274)

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13a. Primary Energy

	Energy kWh/year		Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211)	x	1.22	=	4065.17	(261)
Space heating (secondary)	(215)	x	3.07	=	0	(263)
Energy for water heating	(219)	x	1.22	=	2230.05	(264)
Space and water heating	(261) + (262) + (263) + (264) =				6295.22	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	3.07	=	230.25	(267)
Electricity for lighting	(232)	x	0	=	1183.25	(268)
‘Total Primary Energy			sum of (265)…(271) =		7708.72	(272)
Primary energy kWh/m²/year			(272) ÷ (4) =		94.59	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 2			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 3			5.12	x1/[1/(1.4)+ 0.04]		=	6.79			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Rooflights Type 1			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 2			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 3			0.9264612	x1/[1/(1.7) + 0.04]		=	1.574984			(27b)
Rooflights Type 4			0.6569452	x1/[1/(1.7) + 0.04]		=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21843.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 13.06 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 69.82 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63	

Average = Sum(39)$_{1…12}$ /12= | 108.73 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35

Average = Sum(40)$_{1…12}$ /12= | 1.33 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)$_{1…12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)$_{1…12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)$_{1...12}$ 1248.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

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Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.52	667.11	826.37	996.27	1110.93	1105.86	1055.43	957.06	834.8	665.88	532.08	482.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.76	20.12	20.54	20.84	20.96	20.99	20.99	20.89	20.45	19.9	19.49	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.71	0.49	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.7	19.06	19.47	19.72	19.82	19.83	19.83	19.77	19.4	18.85	18.44	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.96	0.88	0.72	0.52	0.35	0.41	0.69	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	518.97	657.85	792.33	874.48	800.81	570.14	371.55	390.01	579.41	622.9	526.31	480.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1597.31	1552.34	1410.64	1175.48	896.69	586.24	373.77	394.2	637.07	979.96	1307.18	1586.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	802.29	601.1	460.02	216.72	71.33	0	0	0	0	265.65	562.23	822.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3802.08 (98)

Space heating requirement in kWh/m²/year 46.65 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1006.88	792.65	812.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.95	0.93	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	915.36	753.23	755.14	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1314.8	1257.63	1154.83	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	287.59	375.27	297.37	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 960.24 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	71.9	93.82	74.34	0	0	0	0

Total = Sum(107)$_{6...8}$ = 240.06 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.95 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 49.6 (109)

Target Fabric Energy Efficiency (TFEE) 57.04 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.42	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.54	0.53	0.52	0.46	0.45	0.4	0.4	0.39	0.42	0.45	0.47	0.49

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Rooflights Type 2			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Rooflights Type 3			1.1	x1/[1/(1.4) + 0.04]		=	1.54			(27b)
Rooflights Type 4			0.78	x1/[1/(1.4) + 0.04]		=	1.092			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.24	=	20.72			(29)
Walls Type2	2	0	2	x	0.24	=	0.48			(29)
Roof	61.3	7.2	54.1	x	0.15	=	8.12			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 67.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 14.98 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 82.96 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.92	41.56	41.2	39.53	39.21	37.75	37.75	37.48	38.31	39.21	39.85	40.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.88	124.52	124.16	122.48	122.17	120.71	120.71	120.44	121.27	122.17	122.8	123.47	

Average = $Sum(39)_{1...12}$ /12= | 122.48 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.53	1.53	1.52	1.5	1.5	1.48	1.48	1.48	1.49	1.5	1.51	1.51

Average = $Sum(40)_{1...12}$ /12= | 1.5 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = $Sum(44)_{1...12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = $Sum(45)_{1...12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)1…12 1248.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	584.24	782.41	1002.99	1240.81	1404.03	1404.14	1340.05	1205.09	1035.27	798.74	608.84	535.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.96	0.87	0.71	0.53	0.39	0.45	0.71	0.94	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.38	19.67	20.09	20.56	20.85	20.97	20.99	20.99	20.89	20.44	19.81	19.34	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.67	19.67	19.69	19.69	19.7	19.7	19.7	19.7	19.69	19.68	19.68	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.83	0.64	0.43	0.28	0.33	0.61	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.22	18.51	18.92	19.37	19.6	19.69	19.7	19.7	19.65	19.27	18.66	18.19	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.48	18.77	19.19	19.63	19.88	19.98	19.99	19.99	19.93	19.53	18.92	18.45	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DFEE WorkSheet: New dwelling design stage

(93)m=	18.48	18.77	19.19	19.63	19.88	19.98	19.99	19.99	19.93	19.53	18.92	18.45	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.83	0.65	0.45	0.3	0.36	0.63	0.91	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	579.7	764.49	937.39	1024.56	912.32	634.17	407.1	428.32	652.12	723.65	598.43	532.12	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1771.07	1727.32	1575.15	1314.82	999.59	648.9	409.24	432.35	706.45	1091.46	1451.21	1758.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	886.38	647.03	474.5	208.99	64.93	0	0	0	0	273.65	614	912.66	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 4082.13 (98)

Space heating requirement in kWh/m²/year 50.09 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1134.65	893.24	915.32	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.92	0.96	0.94	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	1044.26	853.16	856.69	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1638.2	1566.39	1424.62	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	427.64	530.64	422.54	0	0	0	0	

Total = Sum(104)$_{6..8}$ = 1380.82 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6..8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	106.91	132.66	105.63	0	0	0	0

Total = Sum(107)$_{6..8}$ = 345.21 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 4.24 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 54.32 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.42	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.54	0.53	0.52	0.46	0.45	0.4	0.4	0.39	0.42	0.45	0.47	0.49

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.64	0.64	0.63	0.61	0.6	0.58	0.58	0.58	0.59	0.6	0.61	0.62	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 2			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 3			6.08		x1/[1/(1.4)+ 0.04]	=	8.06			(27)
Windows Type 4			2.14		x1/[1/(1.4)+ 0.04]	=	2.84			(27)
Rooflights Type 1			1.33		x1/[1/(1.4) + 0.04]	=	1.862			(27b)
Rooflights Type 2			1.33		x1/[1/(1.4) + 0.04]	=	1.862			(27b)
Rooflights Type 3			1.1		x1/[1/(1.4) + 0.04]	=	1.54			(27b)
Rooflights Type 4			0.78		x1/[1/(1.4) + 0.04]	=	1.092			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.24	=	20.72			(29)
Walls Type2	2	0	2	x	0.24	=	0.48			(29)
Roof	61.3	7.2	54.1	x	0.15	=	8.12			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	67.98	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	21388.2	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 14.98 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 82.96 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.92	41.56	41.2	39.53	39.21	37.75	37.75	37.48	38.31	39.21	39.85	40.51	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	124.88	124.52	124.16	122.48	122.17	120.71	120.71	120.44	121.27	122.17	122.8	123.47	

Average = Sum(39)1…12 /12= | 122.48 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.53	1.53	1.52	1.5	1.5	1.48	1.48	1.48	1.49	1.5	1.51	1.51

Average = Sum(40)1…12 /12= | 1.5 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)1…12 = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)1…12 = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ | 1617.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	21.82	19.38	15.76	11.93	8.92	7.53	8.14	10.58	14.2	18.03	21.04	22.43	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	380.04	377.75	363.83	341.53	318.92	297.27	283.32	289.52	301.11	323.63	349.4	368.68	(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	618.03	815.2	1033.83	1269.11	1430.63	1428.61	1362.86	1230.32	1061.6	827.7	640.63	568.18	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.86	0.7	0.52	0.38	0.44	0.7	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.42	19.7	20.12	20.58	20.86	20.97	20.99	20.99	20.9	20.46	19.84	19.37	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.66	19.67	19.67	19.69	19.69	19.7	19.7	19.7	19.7	19.69	19.68	19.68	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.82	0.63	0.42	0.27	0.32	0.6	0.9	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.6	18.02	18.61	19.24	19.57	19.68	19.7	19.7	19.63	19.11	18.23	17.55	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.01	18.4	18.95	19.54	19.86	19.97	19.99	19.99	19.91	19.41	18.59	17.96	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.01	18.4	18.95	19.54	19.86	19.97	19.99	19.99	19.91	19.41	18.59	17.96	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.81	0.64	0.44	0.3	0.35	0.62	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	611.44	791.87	956.21	1032.6	914.6	634.64	407.19	428.54	654.73	739.16	626.35	563.71	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1712.23	1681.02	1546.12	1303.11	996.58	648.5	409.2	432.28	704.91	1076.67	1411.36	1698.45	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	818.99	597.5	438.9	194.77	60.99	0	0	0	0	251.11	565.21	844.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3771.71 (98)

Space heating requirement in kWh/m²/year 46.28 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	818.99	597.5	438.9	194.77	60.99	0	0	0	0	251.11	565.21	844.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	911	664.63	488.21	216.65	67.85	0	0	0	0	279.32	628.71	939.09	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 4195.45 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	
Efficiency of water heater												87.3	(216)
(217)m=	89.45	89.38	89.22	88.83	88.12	87.3	87.3	87.3	87.3	88.96	89.35	89.48	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	184.37	161.79	168.21	148.66	144.81	127.66	119.79	135.32	136.3	154.06	165.69	178.96	

Total = Sum(219a)$_{1...12}$ = 1825.62 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		4195.45

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Water heating fuel used			1825.62	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			385.42	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6568.79	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	906.22	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	394.33	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1300.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	200.03	(268)
Total CO2, kg/year		sum of (265)…(271) =		1539.51	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.89	(273)
EI rating (section 14)				84	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 2			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 3			5.12	x1/[1/(1.4)+ 0.04]		=	6.79			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Rooflights Type 1			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 2			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 3			0.9264612	x1/[1/(1.7) + 0.04]		=	1.574984			(27b)
Rooflights Type 4			0.6569452	x1/[1/(1.7) + 0.04]		=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21843.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 13.06 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 69.82 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63

Average = Sum(39)$_{1…12}$ /12= 108.73 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35

Average = Sum(40)$_{1…12}$ /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.49 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 93.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)$_{1…12}$ = 1120.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)$_{1…12}$ = 1468.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.55	48.52	45.12	44.72	41.43	42.82	44.72	45.12	48.52	48.8	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	

Output from water heater (annual)$_{1...12}$ | 2026.06 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63.37	55.67	57.83	51.12	49.41	43.35	41.27	46.26	46.78	53.5	57.36	61.78	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	85.18	82.85	77.73	71	66.41	60.2	55.47	62.17	64.97	71.91	79.66	83.03	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	390.93	388.68	374.46	351.86	328.89	306.72	292.72	299.33	311.24	334.05	360.18	379.51	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

TER WorkSheet: New dwelling design stage

Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	566.2	710.84	867.85	1034.91	1147.5	1139.79	1087.64	992.1	871.25	705.25	574.66	526.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.58	0.43	0.48	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.8	20.16	20.57	20.85	20.97	20.99	20.99	20.9	20.49	19.95	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.87	0.7	0.48	0.32	0.37	0.66	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.92	18.26	18.77	19.34	19.68	19.81	19.83	19.83	19.75	19.25	18.48	17.87	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

TER WorkSheet: New dwelling design stage

(93)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.86	0.7	0.5	0.34	0.39	0.67	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	561.93	697.24	823.49	892.3	807.5	571.53	371.78	390.52	585.48	649.07	565.56	523.49	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1551.47	1515.52	1386.84	1165.56	894.17	585.94	373.75	394.17	636	968.46	1276.32	1539.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3471.98 (98)

Space heating requirement in kWh/m²/year 42.6 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	788.24	588.74	448.75	210.65	69.05	0	0	0	0	254.42	547.91	809.57		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													3717.33	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44		
Efficiency of water heater													80.3	(216)
(217)m=	88.01	87.69	87.04	85.5	82.97	80.3	80.3	80.3	80.3	85.85	87.48	88.1		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.95	203.82	213.66	192.92	192.48	175.15	167.81	187.07	189.13	201.44	211.02	225.25		
Total = Sum(219a)$_{1...12}$ =													2390.71	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3717.33

Water heating fuel used		2390.71	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		350.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6613.72	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	802.94	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	516.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1319.34	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.85	(268)
Total CO2, kg/year		sum of (265)…(271) =		1540.11	(272)

TER = 18.9 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE C - BASELINE

Dwelling type:	Detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	520.69	**(P1)**
Transmission heat loss coefficient:	83	
Summer heat loss coefficient:	603.64	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W1-3 FRONT)	0	1
North (W4 - SIDE N)	0	1
South (W5 - SIDE S)	0	1
East (W6 - REAR E)	0	1
West (RW1-2 FRONT W)	0	1
East (RW3-4 REAR E)	0	1
East (RW5 REAR E)	0	1
East (RW6 REAR E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W1-3 FRONT)	0.98	1	1	0.98	**(P8)**
North (W4 - SIDE N)	0.98	1	1	0.98	**(P8)**
South (W5 - SIDE S)	0.98	1	1	0.98	**(P8)**
East (W6 - REAR E)	0.98	1	1	0.98	**(P8)**
West (RW1-2 FRONT W)	0.98	1	1	0.98	**(P8)**
East (RW3-4 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW5 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW6 REAR E)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
West (W1-3 FRONT)	1 x	4.86	124.8	0.63	0.8	0.98	270.99
North (W4 - SIDE N)	1 x	1.62	86.66	0.63	0.8	0.98	62.72
South (W5 - SIDE S)	1 x	6.08	118.4	0.63	0.8	0.98	321.63
East (W6 - REAR E)	1 x	2.14	124.8	0.63	0.8	0.98	119.32
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	1.1	187.8	0.63	0.8	0.98	92.3
	1 x	0.78	187.8	0.63	0.8	0.98	65.45

SAP 2012 Overheating Assessment

		Total	1378.81	(P3/P4)

Internal gains:

	June	July	August	
Internal gains	434.29	416.42	425.14	
Total summer gains	1895.1	1795.24	1642.8	**(P5)**
Summer gain/loss ratio	3.14	2.97	2.72	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	18.79	20.62	20.47	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Not significant**	

Assessment of likelihood of high internal temperature: Slight

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:05:05

Project Information:

Assessed By:	Jemma Mclaughlan (STRO030065)	**Building Type:**	Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 78.4m²	
Site Reference :	WOODWELL	**Plot Reference:**	HOUSE D - BASELINE
Address :	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU		

Client Details:

Name:
Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.72 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.0 kWh/m²	
		OK

2 Fabric U-values

Element	**Average**	**Highest**	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.38 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	90.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	3.24m²
Windows facing: West	2.59m²
Windows facing: West	0.86m²
Windows facing: South	2.14m²
Roof windows facing: South	2.66m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind
	Closed 10% of daylight hours

10 Key features

Party Walls U-value	0 W/m²K

Thermal Bridge Report

Property Details: HOUSE D - BASELINE

Address: Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in: England
Region: South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

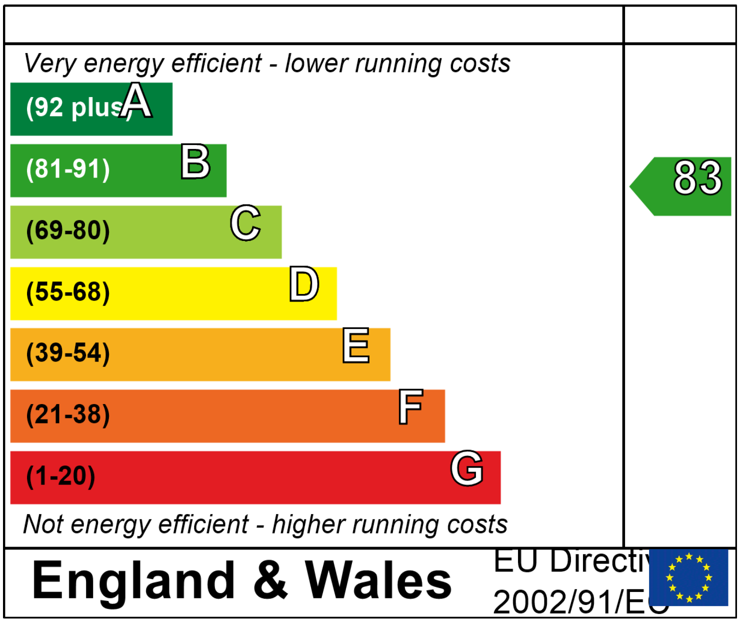
Predicted Energy Assessment

Woodwell Cottage P2	Dwelling type:	Semi-detached House
Woodwell Road	Date of assessment:	24 February 2021
BRISTOL	Produced by:	Jemma Mclaughlan
BS11 9XU	Total floor area:	78.4 m²

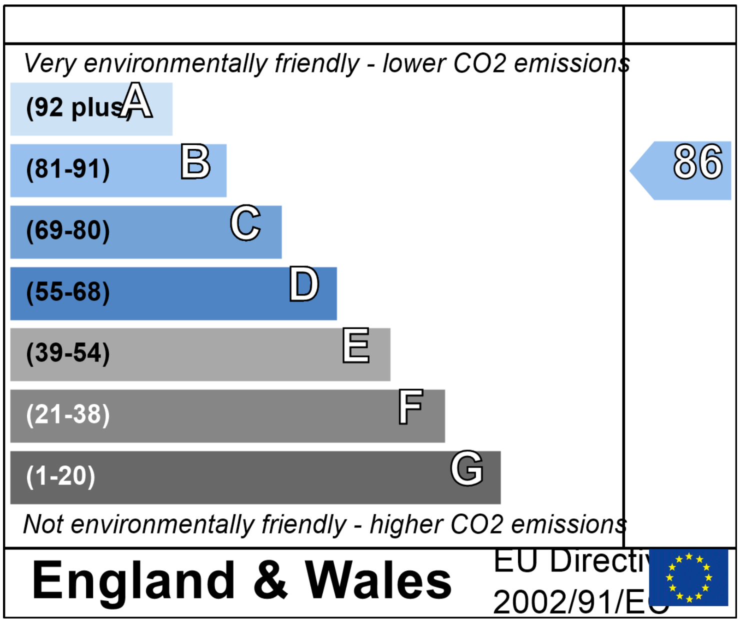
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE D - BASELINE

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House	
Detachment:	Semi-detached	
Year Completed:	2021	
Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m
Living area:	18.35 m² (fraction 0.234)	
Front of dwelling faces:	North	

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.4	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	West	0	0
W4 - SIDE E		EXTERNAL WALLS	West	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	80.83	10.9	69.93	0.24	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.24	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.15	0	N/A
GROUND FLOOR	39.2			0.17		N/A

Internal Elements

Party Elements

PARTY WALL	29.73	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	5.38

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	90%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 60.77 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01

Average = Sum(39)$_{1\ldots12}$ /12= | 100.16 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29

Average = Sum(40)$_{1\ldots12}$ /12= | 1.28 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1\ldots12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1\ldots12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	53.3	47.34	38.5	29.14	21.79	18.39	19.87	25.83	34.67	44.03	51.38	54.78	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	550.72	545.99	524.3	491	457.09	426.91	409.51	418.09	437.48	471	508.02	535.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
West	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(80)
West	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(80)
West	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(80)
West	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(80)
West	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(80)
West	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(80)
West	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(80)
West	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(80)
West	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(80)
West	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(80)
West	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(80)
West	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(80)

West	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(80)
West	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(80)
West	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(80)
West	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(80)
West	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(80)
West	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(80)
West	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(80)
West	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(80)
West	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(80)
West	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(80)
West	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(80)
West	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	699.19	811.53	916.82	1019.08	1081.47	1059.85	1014.39	950.05	877.26	772.77	688.27	661.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.75	0.57	0.42	0.47	0.71	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.01	20.3	20.64	20.87	20.97	20.99	20.99	20.93	20.62	20.16	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.36	0.62	0.89	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.3	18.59	19	19.46	19.74	19.86	19.87	19.87	19.82	19.45	18.81	18.26		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.66	18.92	19.3	19.74	20.01	20.12	20.13	20.13	20.08	19.72	19.12	18.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	18.92	19.3	19.74	20.01	20.12	20.13	20.13	20.08	19.72	19.12	18.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.85	0.7	0.5	0.34	0.38	0.64	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	686.45	783.8	853.09	863.33	756.84	532.31	347.1	364.88	557.87	682.36	665.16	651.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1467.87	1429.09	1300.92	1085.65	829.87	544.29	348.65	367.51	592.49	911.39	1207.64	1456.6	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	581.37	433.64	333.18	160.07	54.34	0	0	0	0	170.4	390.58	598.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2722.52 (98)

Space heating requirement in kWh/m²/year 34.73 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	581.37	433.64	333.18	160.07	54.34	0	0	0	0	170.4	390.58	598.93		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	646.69	482.36	370.62	178.06	60.44	0	0	0	0	189.55	434.46	666.22		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3028.39	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91		
Efficiency of water heater													87.3	(216)

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(217)m=	89.32	89.24	89.08	88.71	88.07	87.3	87.3	87.3	87.3	88.73	89.18	89.34	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.09	159.8	166.16	146.83	142.95	125.96	118.21	133.51	134.47	152.36	163.73	176.74

Total = Sum(219a)$_{1...12}$ = 1802.82 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3028.39	
Water heating fuel used			1802.82	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			376.49	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5370	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	105.39	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.74	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	49.66	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)...(254) = 347.68 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.18	(257)
SAP rating (Section 12)		83.49	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	654.13	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.41	(264)

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Space and water heating	(261) + (262) + (263) + (264) =			1043.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.4	(268)
Total CO2, kg/year		sum of (265)…(271) =		1277.86	(272)
CO2 emissions per m²		(272) ÷ (4) =		16.3	(273)
EI rating (section 14)				86	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3694.64	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2199.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5894.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1155.82	(268)
'Total Primary Energy		sum of (265)…(271) =		7280.15	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		92.86	(273)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ — 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)

Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m
set (104)m to zero if (104)m < 3 × (98)m

(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0

Total = Sum(104)$_{6...8}$ = 478.84 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 119.71 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.53 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	50.3	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23461.84	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 60.77 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01	

Average = $Sum(39)_{1...12}$ /12= | 100.16 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29

Average = $Sum(40)_{1...12}$ /12= | 1.28 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = $Sum(44)_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = $Sum(45)_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ — 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.87	0.71	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.55	19.74	20.04	20.43	20.75	20.93	20.98	20.97	20.84	20.41	19.91	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.61	0.42	0.47	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.53	18.72	19.02	19.4	19.69	19.84	19.87	19.87	19.78	19.39	18.9	18.51	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.96	19.26	19.64	19.94	20.1	20.13	20.13	20.03	19.63	19.13	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	18.96	19.26	19.64	19.94	20.1	20.13	20.13	20.03	19.63	19.13	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.63	0.45	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.85	559.65	646.08	705.95	674.92	511.25	343.56	358.76	505.01	524.16	461.39	434.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1479.06	1432.82	1296.34	1076.09	823.08	542.31	348.26	366.86	587.64	902.15	1208.72	1469.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	755.31	586.77	483.8	266.5	110.23	0	0	0	0	281.23	538.08	770.26	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3792.17 (98)

Space heating requirement in kWh/m²/year 48.37 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	927.19	729.91	747.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.85	0.91	0.89	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	789.47	666.92	663.91	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	147.53	212.38	168.54	0	0	0	0	

Total = Sum(104)6...8 = 528.45 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)6...8 = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	36.88	53.1	42.13	0	0	0	0

Total = Sum(107)6...8 = 132.11 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.69 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	50.05	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total			m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40	=	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20	=	0	(6b)
Number of intermittent fans							3	x 10	=	30	(7a)
Number of passive vents							0	x 10	=	0	(7b)
Number of flueless gas fires							0	x 40	=	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			5.38000011444092	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 60.77 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01	

Average = Sum(39)$_{1…12}$ /12= | 100.16 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29

Average = Sum(40)$_{1…12}$ /12= | 1.28 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)1…12 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	21.73	19.3	15.7	11.88	8.88	7.5	8.1	10.53	14.14	17.95	20.95	22.34	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	371.56	369.25	355.58	333.74	311.67	290.53	276.94	283.1	294.48	316.52	341.72	360.51	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	498.93	597	691.88	785.25	844.44	830.08	792.8	737.54	670.99	575.28	496.34	468.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.78	20.07	20.45	20.76	20.94	20.99	20.98	20.85	20.44	19.94	19.56	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	17.98	18.25	18.68	19.23	19.63	19.83	19.87	19.87	19.75	19.22	18.5	17.94		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.35	18.61	19.01	19.51	19.9	20.09	20.13	20.13	20.01	19.5	18.84	18.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.35	18.61	19.01	19.51	19.9	20.09	20.13	20.13	20.01	19.5	18.84	18.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.62	0.43	0.49	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	496.27	589.86	671.64	723.43	683.65	513.68	344.02	359.68	512.19	545.74	490.99	466.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1436.71	1397.16	1270.92	1063.13	818.83	541.7	348.21	366.78	585.84	889.28	1179.31	1426.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.69	542.5	445.86	244.58	100.58	0	0	0	0	255.59	495.59	714.49	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3498.89 (98)

Space heating requirement in kWh/m²/year 44.63 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	699.69	542.5	445.86	244.58	100.58	0	0	0	0	255.59	495.59	714.49	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	778.29	603.45	495.96	272.06	111.87	0	0	0	0	284.31	551.27	794.77	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3891.98 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.4	89.35	89.24	88.98	88.44	87.3	87.3	87.3	87.3	88.98	89.29	89.42	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.93	159.62	165.87	146.39	142.35	125.96	118.21	133.51	134.47	151.93	163.51	176.6	

Total = Sum(219a)$_{1...12}$ = 1800.36 (219)

Annual totals	kWh/year	kWh/year	
Space heating fuel used, main system 1		3891.98	
Water heating fuel used		1800.36	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		383.81	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6238.45	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216 =	840.67	(261)
Space heating (secondary)	(215) x	0.519 =	0	(263)
Water heating	(219) x	0.216 =	388.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =		1229.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519 =	38.93	(267)
Electricity for lighting	(232) x	0.519 =	199.2	(268)
Total CO2, kg/year		sum of (265)…(271) =	1467.67	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.72	(273)
EI rating (section 14)			84	(274)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		10.55	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)			
Total fabric heat loss	(33) + (36) =	53.74	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37		
										Average = $Sum(39)_{1...12}$ /12=			92.59	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19		
										Average = $Sum(40)_{1...12}$ /12=			1.18	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.43	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)		
if TFA £ 13.9, N = 1		
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	91.96	(43)
Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)		

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15		
										Total = $Sum(44)_{1...12}$ =			1103.46	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27		
										Total = $Sum(45)_{1...12}$ =			1446.81	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel		0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)			
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)			
Water storage loss:			
a) If manufacturer’s declared loss factor is known (kWh/day):		0	(48)
Temperature factor from Table 2b		0	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0	(50)
b) If manufacturer’s declared cylinder loss factor is not known:			
Hot water storage loss factor from Table 2 (kWh/litre/day)		0	(51)
If community heating see section 4.3			
Volume factor from Table 2a		0	(52)
Temperature factor from Table 2b		0	(53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)$_{1...12}$ | 1997.22 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)
Total internal gains =					(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m								
(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3173.97 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3398.26 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23

Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4

Total = Sum(219a)$_{1...12}$ = 2356.83 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3398.26	
Water heating fuel used			2356.83	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE D - BASELINE

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	60.8	
Summer heat loss coefficient:	594.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
West (W3 - SIDE E)	0	1
West (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
West (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
West (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
West (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
West (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	423.91	406.51	415.09	
Total summer gains	1135.05	1077.98	1010.14	**(P5)**
Summer gain/loss ratio	1.91	1.81	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.56	19.46	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:05:01

Project Information:

Assessed By: Jemma Mclaughlan (STRO030065) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.4m²

Site Reference : WOODWELL **Plot Reference:** HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

Client Details:

Name:

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	18.72 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	50.0 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	**OK**
Party wall	0.00 (max. 0.20)	-	**OK**
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.15 (max. 0.20)	0.15 (max. 0.35)	**OK**
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.38 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system: Database: (rev 472, product index 017179):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi)
Efficiency 89.0 % SEDBUK2009
Minimum 88.0 % **OK**

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	90.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	3.24m²
Windows facing: East	2.59m²
Windows facing: East	0.86m²
Windows facing: South	2.14m²
Roof windows facing: South	2.66m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

Party Walls U-value	0 W/m²K

Thermal Bridge Report

Property Details: HOUSE E - BASELINE

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

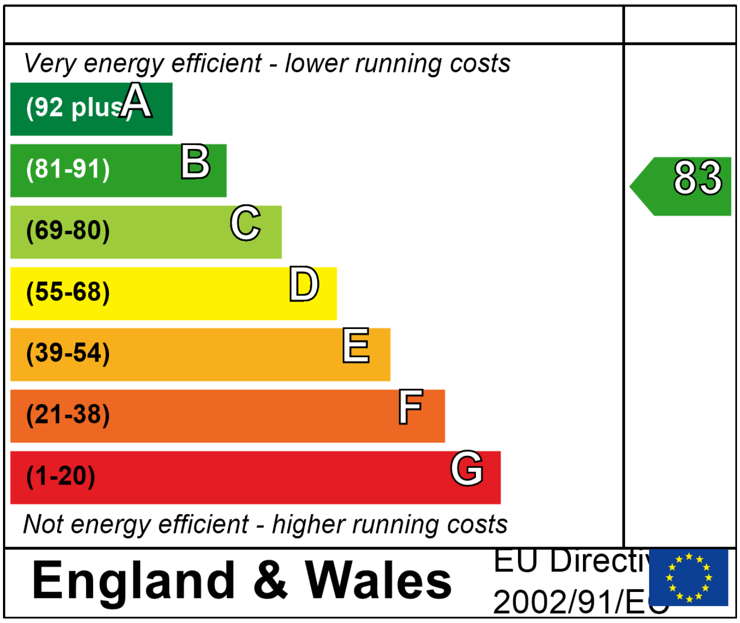
Predicted Energy Assessment

Woodwell Cottage P2	Dwelling type:	Semi-detached House
Woodwell Road	Date of assessment:	24 February 2021
BRISTOL	Produced by:	Jemma Mclaughlan
BS11 9XU	Total floor area:	78.4 m²

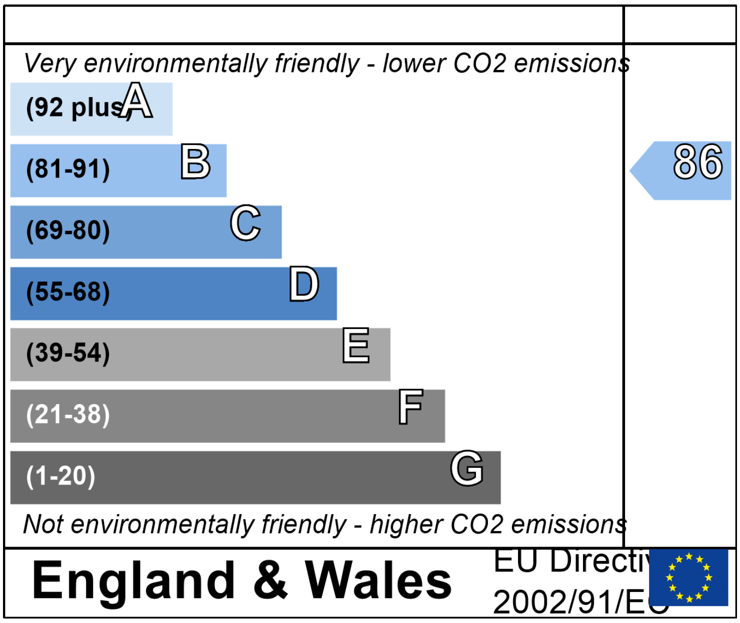
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE E - BASELINE

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m

Living area:	18.35 m² (fraction 0.234)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.4	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	East	0	0
W4 - SIDE E		EXTERNAL WALLS	East	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
EXTERNAL WALLS	80.83	10.9	69.93	0.24	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.24	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.15	0	N/A
GROUND FLOOR	39.2			0.17		N/A

Internal Elements

Party Elements

PARTY WALL	29.73	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	5.38

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	90%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 60.77 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01		
									Average = Sum(39)1…12 /12=				100.16	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29		
									Average = Sum(40)1…12 /12=				1.28	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15		
									Total = Sum(44)1…12 =				1103.46	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27		
									Total = Sum(45)1…12 =				1446.81	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)1…12 — 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	53.3	47.34	38.5	29.14	21.79	18.39	19.87	25.83	34.67	44.03	51.38	54.78	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	550.72	545.99	524.3	491	457.09	426.91	409.51	418.09	437.48	471	508.02	535.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
East	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(76)
East	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(76)
East	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(76)
East	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(76)
East	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(76)
East	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(76)
East	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(76)
East	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(76)
East	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(76)
East	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(76)
East	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(76)
East	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(76)
East	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(76)
East	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(76)
East	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(76)
East	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(76)
East	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(76)
East	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(76)
East	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(76)
East	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(76)
East	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(76)
East	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(76)
East	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(76)
East	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(76)

South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	699.19	811.53	916.82	1019.08	1081.47	1059.85	1014.39	950.05	877.26	772.77	688.27	661.3	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.89	0.75	0.57	0.42	0.47	0.71	0.92	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.82	20.01	20.3	20.64	20.87	20.97	20.99	20.99	20.93	20.62	20.16	19.78	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.94	0.85	0.69	0.48	0.32	0.36	0.62	0.89	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.3	18.59	19	19.46	19.74	19.86	19.87	19.87	19.82	19.45	18.81	18.26	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.66	18.92	19.3	19.74	20.01	20.12	20.13	20.13	20.08	19.72	19.12	18.62	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.66	18.92	19.3	19.74	20.01	20.12	20.13	20.13	20.08	19.72	19.12	18.62	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.93	0.85	0.7	0.5	0.34	0.38	0.64	0.88	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	686.45	783.8	853.09	863.33	756.84	532.31	347.1	364.88	557.87	682.36	665.16	651.58	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1467.87	1429.09	1300.92	1085.65	829.87	544.29	348.65	367.51	592.49	911.39	1207.64	1456.6	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	581.37	433.64	333.18	160.07	54.34	0	0	0	0	170.4	390.58	598.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2722.52 (98)

Space heating requirement in kWh/m²/year 34.73 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	581.37	433.64	333.18	160.07	54.34	0	0	0	0	170.4	390.58	598.93	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	646.69	482.36	370.62	178.06	60.44	0	0	0	0	189.55	434.46	666.22	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3028.39 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

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(217)m=	89.32	89.24	89.08	88.71	88.07	87.3	87.3	87.3	87.3	88.73	89.18	89.34	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.09	159.8	166.16	146.83	142.95	125.96	118.21	133.51	134.47	152.36	163.73	176.74

Total = $Sum(219a)_{1...12}$ = 1802.82 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3028.39	
Water heating fuel used			1802.82	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			376.49	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5370	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	105.39	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.74	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	49.66	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 347.68 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.18	(257)
SAP rating (Section 12)		83.49	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	654.13	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.41	(264)

Space and water heating	(261) + (262) + (263) + (264) =			1043.54	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	195.4	(268)
Total CO2, kg/year		sum of (265)…(271) =		1277.86	(272)
CO2 emissions per m²		(272) ÷ (4) =		16.3	(273)
EI rating (section 14)				86	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3694.64	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2199.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5894.08	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1155.82	(268)
'Total Primary Energy		sum of (265)…(271) =		7280.15	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		92.86	(273)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 478.84 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 119.71 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.53 (108)

TFEE WorkSheet: New dwelling design stage

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.3 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 60.77 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01	

Average = Sum(39)$_{1…12}$ /12= | 100.16 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29	

Average = Sum(40)$_{1…12}$ /12= | 1.28 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1…12 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.95	0.87	0.71	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.55	19.74	20.04	20.43	20.75	20.93	20.98	20.97	20.84	20.41	19.91	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.82	0.61	0.42	0.47	0.77	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.53	18.72	19.02	19.4	19.69	19.84	19.87	19.87	19.78	19.39	18.9	18.51	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.77	18.96	19.26	19.64	19.94	20.1	20.13	20.13	20.03	19.63	19.13	18.75	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.77	18.96	19.26	19.64	19.94	20.1	20.13	20.13	20.03	19.63	19.13	18.75	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.82	0.63	0.45	0.5	0.78	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.85	559.65	646.08	705.95	674.92	511.25	343.56	358.76	505.01	524.16	461.39	434.27	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1479.06	1432.82	1296.34	1076.09	823.08	542.31	348.26	366.86	587.64	902.15	1208.72	1469.56	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	755.31	586.77	483.8	266.5	110.23	0	0	0	0	281.23	538.08	770.26	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3792.17 (98)

Space heating requirement in kWh/m²/year 48.37 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	927.19	729.91	747.87	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.85	0.91	0.89	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	789.47	666.92	663.91	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	147.53	212.38	168.54	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 528.45 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	36.88	53.1	42.13	0	0	0	0

Total = Sum(107)$_{6...8}$ = 132.11 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.69 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	50.05	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5.38000011444092	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.42	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.39	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.49	0.48	0.47	0.42	0.41	0.37	0.37	0.36	0.39	0.41	0.43	0.45

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.62	0.62	0.61	0.59	0.59	0.57	0.57	0.56	0.57	0.59	0.59	0.6	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.4) + 0.04]		=	1.862			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.24	=	16.78			(29)
Walls Type2	2.12	0	2.12	x	0.24	=	0.51			(29)
Roof	57.4	2.66	54.74	x	0.15	=	8.21			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	50.3	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23461.84	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.48 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 60.77 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.46	41.15	40.84	39.39	39.12	37.86	37.86	37.63	38.35	39.12	39.67	40.24	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	102.23	101.92	101.61	100.17	99.9	98.64	98.64	98.4	99.12	99.9	100.44	101.01

Average = $Sum(39)_{1...12}$ /12= 100.16 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.3	1.3	1.3	1.28	1.27	1.26	1.26	1.26	1.26	1.27	1.28	1.29

Average = $Sum(40)_{1...12}$ /12= 1.28 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = $Sum(44)_{1...12}$ = 1103.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = $Sum(45)_{1...12}$ = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	21.73	19.3	15.7	11.88	8.88	7.5	8.1	10.53	14.14	17.95	20.95	22.34	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	371.56	369.25	355.58	333.74	311.67	290.53	276.94	283.1	294.48	316.52	341.72	360.51	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	498.93	597	691.88	785.25	844.44	830.08	792.8	737.54	670.99	575.28	496.34	468.13	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.59	19.78	20.07	20.45	20.76	20.94	20.99	20.98	20.85	20.44	19.94	19.56	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.84	19.84	19.84	19.86	19.86	19.87	19.87	19.88	19.87	19.86	19.86	19.85	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.6	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	17.98	18.25	18.68	19.23	19.63	19.83	19.87	19.87	19.75	19.22	18.5	17.94		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.35	18.61	19.01	19.51	19.9	20.09	20.13	20.13	20.01	19.5	18.84	18.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.35	18.61	19.01	19.51	19.9	20.09	20.13	20.13	20.01	19.5	18.84	18.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.92	0.81	0.62	0.43	0.49	0.76	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	496.27	589.86	671.64	723.43	683.65	513.68	344.02	359.68	512.19	545.74	490.99	466.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1436.71	1397.16	1270.92	1063.13	818.83	541.7	348.21	366.78	585.84	889.28	1179.31	1426.58	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.69	542.5	445.86	244.58	100.58	0	0	0	0	255.59	495.59	714.49	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3498.89 (98)

Space heating requirement in kWh/m²/year 44.63 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 89.9 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	699.69	542.5	445.86	244.58	100.58	0	0	0	0	255.59	495.59	714.49	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	778.29	603.45	495.96	272.06	111.87	0	0	0	0	284.31	551.27	794.77	

Total (kWh/year) =Sum(211)1...5,10....12= 3891.98 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)1...5,10....12= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.4	89.35	89.24	88.98	88.44	87.3	87.3	87.3	87.3	88.98	89.29	89.42	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.93	159.62	165.87	146.39	142.35	125.96	118.21	133.51	134.47	151.93	163.51	176.6	

Total = $Sum(219a)_{1...12}$ = 1800.36 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3891.98	
Water heating fuel used			1800.36	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			383.81	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6238.45	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	840.67	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	388.88	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1229.55	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	199.2	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.67	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		18.72	(273)
EI rating (section 14)				84	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - BASELINE

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)$_{1...12}$ — 1997.22 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

TER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3173.97 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				3398.26	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23		
Efficiency of water heater													80.3	(216)

TER WorkSheet: New dwelling design stage

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4

Total = Sum(219a)$_{1...12}$ = 2356.83 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3398.26	
Water heating fuel used		2356.83	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE E - BASELINE

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	60.8	
Summer heat loss coefficient:	594.77	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
East (W3 - SIDE E)	0	1
East (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
East (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
East (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
East (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
East (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	423.91	406.51	415.09	
Total summer gains	1135.05	1077.98	1010.14	**(P5)**
Summer gain/loss ratio	1.91	1.81	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.56	19.46	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

APPENDIX C: SAP Calculation Worksheets – IMPROVED (BE LEAN)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:58

Project Information:

Assessed By:	Jemma Mclaughlan (STRO030065)	**Building Type:**	Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 81.5m²	
Site Reference :	WOODWELL	**Plot Reference:**	HOUSE C - IMPROVED
Address :	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU		

Client Details:

Name:
Address :

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 system: Mains gas		
Fuel factor: 1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.9 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.03 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: West	4.86m²
Windows facing: North	1.62m²
Windows facing: South	6.08m²
Windows facing: East	2.14m²
Roof windows facing: West	2.66m²
Roof windows facing: East	2.66m²
Roof windows facing: East	1.1m²
Roof windows facing: East	0.78m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

None

Thermal Bridge Report

Property Details: HOUSE C - IMPROVED

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0578

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	9.97	E2	[UD]
Sill	0.04	5.4	E3	[A]
Jamb	0.05	22.8	E4	[A]
Ground floor (normal)	0.08	25.7	E5	[UD]
Intermediate floor within a dwelling	0.07	25.7	E6	[A]
Eaves (insulation at rafter level)	0.04	15.65	E11	[A]
Gable (insulation at rafter level)	0.04	19.28	E13	[A]
Corner (normal)	0.09	15.8	E16	[A]

Roof Junctions Details:

Head	0.08	9.47	R1	[D]
Sill	0.06	9.47	R2	[D]
Jamb	0.08	17.2	R3	[D]
Ridge (vaulted ceiling)	0.08	9.3	R4	[D]

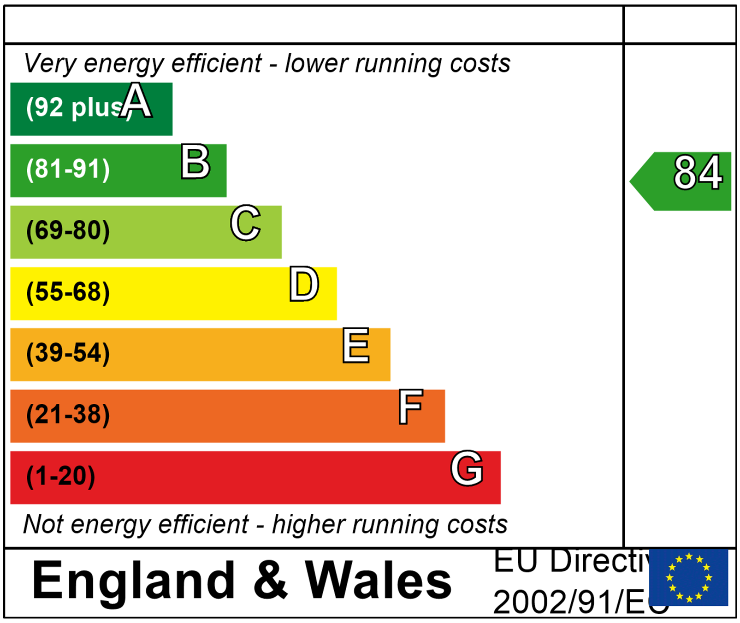
Predicted Energy Assessment

Woodwell Cottage P2 Woodwell Road BRISTOL BS11 9XU	Dwelling type: Date of assessment: Produced by: Total floor area:	Detached House 24 February 2021 Jemma Mclaughlan 81.5 m²

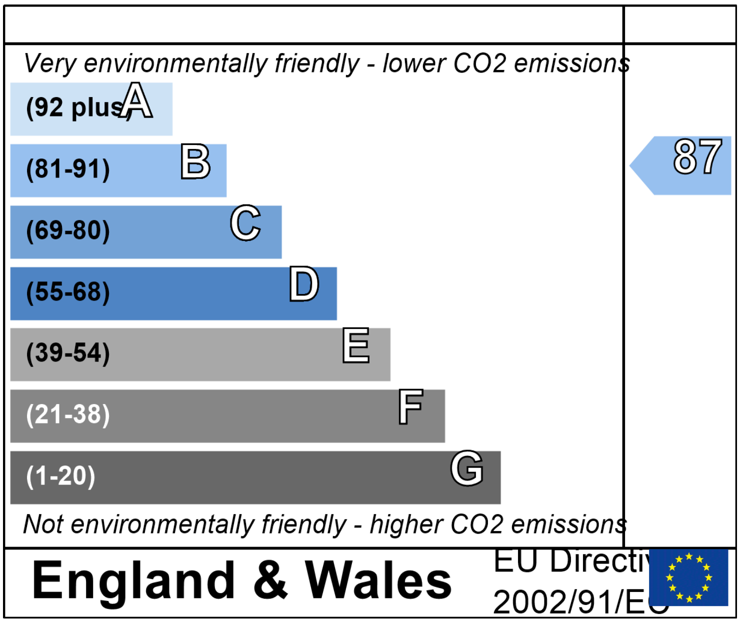
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE C - IMPROVED

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	40.75 m²	2.6 m
Floor 1	40.75 m²	2.24 m

Living area:	18.3 m² (fraction 0.225)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-3 FRONT	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - SIDE S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W6 - REAR E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 FRONT W	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW3-4 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW5 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW6 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	1.93	1
W1-3 FRONT	16mm or more	0.8	0.63	1.4	1.62	3
W4 - SIDE N	16mm or more	0.8	0.63	1.4	1.62	1
W5 - SIDE S	16mm or more	0.8	0.63	1.4	6.08	1
W6 - REAR E	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 FRONT W	16mm or more	0.8	0.63	1.3	1.33	2
RW3-4 REAR E	16mm or more	0.8	0.63	1.3	1.33	2
RW5 REAR E	16mm or more	0.8	0.63	1.3	1.1	1
RW6 REAR E	16mm or more	0.8	0.63	1.3	0.78	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	West	0	0
W1-3 FRONT		EXTERNAL WALLS	West	0	0
W4 - SIDE N		EXTERNAL WALLS	North	0	0
W5 - SIDE S		EXTERNAL WALLS	South	0	0
W6 - REAR E		EXTERNAL WALLS	East	0	0
RW1-2 FRONT W		ROOF	West	0.001	0

RW3-4 REAR E	ROOF	East	0.001	0
RW5 REAR E	ROOF	East	0.001	0
RW6 REAR E	ROOF	East	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	102.95	16.63	86.32	0.2	0	False	N/A
DORMER CHEEKS	2	0	2	0.2	0	False	N/A
ROOF	61.3	7.2	54.1	0.14	0		N/A
GROUND FLOOR	40.75			0.17			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0578

	Length	Psi-value		
	9.97	0.05	E2	Other lintels (including other steel lintels)
[Approved]	5.4	0.04	E3	Sill
[Approved]	22.8	0.05	E4	Jamb
	25.7	0.08	E5	Ground floor (normal)
[Approved]	25.7	0.07	E6	Intermediate floor within a dwelling
[Approved]	15.65	0.04	E11	Eaves (insulation at rafter level)
[Approved]	19.28	0.04	E13	Gable (insulation at rafter level)
[Approved]	15.8	0.09	E16	Corner (normal)
	9.47	0.08	R1	Head
	9.47	0.06	R2	Sill
	17.2	0.08	R3	Jamb
	9.3	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open

SAP Input

	Boiler interlock: Yes Delayed start
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False
Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 2			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 3			6.08		x1/[1/(1.4)+ 0.04]	=	8.06			(27)
Windows Type 4			2.14		x1/[1/(1.4)+ 0.04]	=	2.84			(27)
Rooflights Type 1			1.33		x1/[1/(1.3) + 0.04]	=	1.729			(27b)
Rooflights Type 2			1.33		x1/[1/(1.3) + 0.04]	=	1.729			(27b)
Rooflights Type 3			1.1		x1/[1/(1.3) + 0.04]	=	1.43			(27b)
Rooflights Type 4			0.78		x1/[1/(1.3) + 0.04]	=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 11.97 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 75.23 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34	

Average = $Sum(39)_{1…12}$ /12= | 112.65 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39

Average = $Sum(40)_{1…12}$ /12= | 1.38 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = $Sum(44)_{1…12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = $Sum(45)_{1…12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ 1617.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	(66)

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

(67)m=	49.6	44.05	35.83	27.12	20.28	17.12	18.5	24.04	32.27	40.97	47.82	50.98	(67)

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

(68)m=	332.16	335.61	326.92	308.43	285.09	263.15	248.49	245.05	253.73	272.22	295.57	317.5	(68)

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

(69)m=	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	559.31	555.06	533.67	500.39	466.24	435.58	417.57	425.73	444.8	478.3	515.6	543.89	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	7.81	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	14.93	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	25.37	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	40.76	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	54.9	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	58.78	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	54.87	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	43.54	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	30.51	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	17.78	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	9.64	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	6.51	(74)
East	0.9x	1	x	2.14	x	19.64	x	0.63	x	0.8	=	19.06	(76)
East	0.9x	1	x	2.14	x	38.42	x	0.63	x	0.8	=	37.29	(76)
East	0.9x	1	x	2.14	x	63.27	x	0.63	x	0.8	=	61.42	(76)
East	0.9x	1	x	2.14	x	92.28	x	0.63	x	0.8	=	89.58	(76)
East	0.9x	1	x	2.14	x	113.09	x	0.63	x	0.8	=	109.78	(76)
East	0.9x	1	x	2.14	x	115.77	x	0.63	x	0.8	=	112.38	(76)
East	0.9x	1	x	2.14	x	110.22	x	0.63	x	0.8	=	106.99	(76)
East	0.9x	1	x	2.14	x	94.68	x	0.63	x	0.8	=	91.9	(76)
East	0.9x	1	x	2.14	x	73.59	x	0.63	x	0.8	=	71.43	(76)
East	0.9x	1	x	2.14	x	45.59	x	0.63	x	0.8	=	44.25	(76)
East	0.9x	1	x	2.14	x	24.49	x	0.63	x	0.8	=	23.77	(76)
East	0.9x	1	x	2.14	x	16.15	x	0.63	x	0.8	=	15.68	(76)
South	0.9x	1	x	6.08	x	46.75	x	0.63	x	0.8	=	128.94	(78)
South	0.9x	1	x	6.08	x	76.57	x	0.63	x	0.8	=	211.17	(78)
South	0.9x	1	x	6.08	x	97.53	x	0.63	x	0.8	=	268.99	(78)
South	0.9x	1	x	6.08	x	110.23	x	0.63	x	0.8	=	304.01	(78)
South	0.9x	1	x	6.08	x	114.87	x	0.63	x	0.8	=	316.8	(78)
South	0.9x	1	x	6.08	x	110.55	x	0.63	x	0.8	=	304.88	(78)
South	0.9x	1	x	6.08	x	108.01	x	0.63	x	0.8	=	297.88	(78)
South	0.9x	1	x	6.08	x	104.89	x	0.63	x	0.8	=	289.29	(78)
South	0.9x	1	x	6.08	x	101.89	x	0.63	x	0.8	=	280.99	(78)
South	0.9x	1	x	6.08	x	82.59	x	0.63	x	0.8	=	227.76	(78)
South	0.9x	1	x	6.08	x	55.42	x	0.63	x	0.8	=	152.83	(78)
South	0.9x	1	x	6.08	x	40.4	x	0.63	x	0.8	=	111.41	(78)

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West	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.8	=	43.3	(80)
West	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.8	=	84.7	(80)
West	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.8	=	139.49	(80)
West	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.8	=	203.43	(80)
West	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.8	=	249.31	(80)
West	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.8	=	255.22	(80)
West	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.8	=	242.98	(80)
West	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.8	=	208.71	(80)
West	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.8	=	162.23	(80)
West	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.8	=	100.5	(80)
West	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.8	=	53.99	(80)
West	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.8	=	35.61	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.79	517.51	783.91	1074.27	1279.79	1299.53	1241.16	1086.49	885.88	593.84	346.49	238.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	843.11	1072.57	1317.58	1574.66	1746.04	1735.11	1658.74	1512.22	1330.68	1072.13	862.09	782.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.89	0.75	0.57	0.41	0.29	0.34	0.56	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.11	20.47	20.8	20.95	20.99	21	21	20.97	20.71	20.19	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.86	0.7	0.51	0.33	0.21	0.25	0.47	0.8	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.24	18.66	19.16	19.58	19.74	19.78	19.79	19.79	19.76	19.49	18.79	18.16	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.59	18.99	19.46	19.85	20.01	20.05	20.06	20.06	20.03	19.77	19.1	18.52	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.44	18.84	19.31	19.7	19.86	19.9	19.91	19.91	19.88	19.62	18.95	18.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.93	0.85	0.7	0.51	0.34	0.22	0.26	0.48	0.79	0.94	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	817.77	999.45	1120.57	1096.36	890.05	587.53	368.37	389.7	632.15	846.78	811.82	764.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1616.85	1589.68	1457.8	1216.79	917.29	591	368.76	390.45	646.59	1013.68	1337.86	1605.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	594.51	396.63	250.9	86.71	20.27	0	0	0	0	124.18	378.75	626.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2478.19 (98)

Space heating requirement in kWh/m²/year 30.41 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	594.51	396.63	250.9	86.71	20.27	0	0	0	0	124.18	378.75	626.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.3	441.2	279.09	96.45	22.55	0	0	0	0	138.13	421.3	696.6	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2756.61 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	
Efficiency of water heater												87.3	(216)
(217)m=	89.32	89.19	88.91	88.31	87.65	87.3	87.3	87.3	87.3	88.52	89.15	89.36	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	184.64	162.13	168.8	149.53	145.6	127.66	119.79	135.32	136.3	154.84	166.05	179.19	

Total = Sum(219a)$_{1...12}$ = 1829.87 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2756.61

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Water heating fuel used			1829.87	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			350.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5099.16	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)		Fuel Cost £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	95.93	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	63.68	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	46.22	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost	(245)...(247) + (250)…(254) =	335.72	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.11	(257)
SAP rating (Section 12)		84.45	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	595.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	395.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			990.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.85	(268)
Total CO2, kg/year		sum of (265)…(271) =		1211.45	(272)
CO2 emissions per m²		(272) ÷ (4) =		14.86	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3363.07	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2232.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5595.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1075.68	(268)
'Total Primary Energy		sum of (265)…(271) =		6901.43	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		84.68	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 2			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 3			5.12	x1/[1/(1.4)+ 0.04]		=	6.79			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Rooflights Type 1			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 2			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 3			0.9264612	x1/[1/(1.7) + 0.04]		=	1.574984			(27b)
Rooflights Type 4			0.6569452	x1/[1/(1.7) + 0.04]		=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	56.77	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	21843.02	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 13.06 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss | (33) + (36) = | 69.82 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K | (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63

Average = $Sum(39)_{1...12}$ /12= | 108.73 | (39)

Heat loss parameter (HLP), W/m²K | (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35

Average = $Sum(40)_{1...12}$ /12= | 1.33 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = $Sum(44)_{1...12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = $Sum(45)_{1...12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year | (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)1…12 | 1248.5 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.52	667.11	826.37	996.27	1110.93	1105.86	1055.43	957.06	834.8	665.88	532.08	482.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.76	20.12	20.54	20.84	20.96	20.99	20.99	20.89	20.45	19.9	19.49	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.71	0.49	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.7	19.06	19.47	19.72	19.82	19.83	19.83	19.77	19.4	18.85	18.44	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.96	0.88	0.72	0.52	0.35	0.41	0.69	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	518.97	657.85	792.33	874.48	800.81	570.14	371.55	390.01	579.41	622.9	526.31	480.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1597.31	1552.34	1410.64	1175.48	896.69	586.24	373.77	394.2	637.07	979.96	1307.18	1586.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	802.29	601.1	460.02	216.72	71.33	0	0	0	0	265.65	562.23	822.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3802.08 (98)

Space heating requirement in kWh/m²/year 46.65 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1006.88	792.65	812.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.95	0.93	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	915.36	753.23	755.14	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1314.8	1257.63	1154.83	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	287.59	375.27	297.37	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 960.24 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(107)m=	0	0	0	0	0	71.9	93.82	74.34	0	0	0	0

Total = Sum(107)$_{6...8}$ = 240.06 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.95 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 49.6 (109)

Target Fabric Energy Efficiency (TFEE) 57.04 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 2			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 3			1.1	x1/[1/(1.3) + 0.04]		=	1.43			(27b)
Rooflights Type 4			0.78	x1/[1/(1.3) + 0.04]		=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 11.97 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 75.23 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34	

Average = Sum(39)1…12 /12= | 112.65 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39	

Average = Sum(40)1…12 /12= | 1.38 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)1…12 = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)1…12 = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)1…12 — 1248.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	584.24	782.41	1002.99	1240.81	1404.03	1404.14	1340.05	1205.09	1035.27	798.74	608.84	535.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) — 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.95	0.85	0.68	0.49	0.36	0.42	0.68	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.54	19.83	20.23	20.66	20.9	20.98	21	20.99	20.92	20.53	19.93	19.49	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.81	0.61	0.41	0.26	0.31	0.58	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.74	19.14	19.53	19.72	19.78	19.79	19.79	19.75	19.43	18.86	18.41	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.98	19.38	19.78	19.98	20.05	20.06	20.06	20.01	19.68	19.1	18.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.7	18.98	19.38	19.78	19.98	20.05	20.06	20.06	20.01	19.68	19.1	18.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.81	0.62	0.43	0.29	0.34	0.6	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	579.84	763.91	931.98	1002.79	872.41	598.4	384.22	404.67	624.29	717.12	598.28	532.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1646.02	1606.62	1466.22	1226.08	931.44	607.21	385.38	406.97	661.21	1020.83	1354.36	1638.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	793.24	566.3	397.47	160.77	43.92	0	0	0	0	225.96	544.37	822.7	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3554.73 (98)

Space heating requirement in kWh/m²/year 43.62 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1047.27	824.45	845.3	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.97	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	988.97	800.31	808.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1638.2	1566.39	1424.62	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	467.45	569.97	458.49	0	0	0	0	

Total = $Sum(104)_{6...8}$ = 1495.91 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = $Sum(104)_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	116.86	142.49	114.62	0	0	0	0

Total = $Sum(107)_{6...8}$ = 373.98 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 4.59 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency — (99) + (108) = 48.2 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 2			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 3			1.1	x1/[1/(1.3) + 0.04]		=	1.43			(27b)
Rooflights Type 4			0.78	x1/[1/(1.3) + 0.04]		=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 11.97 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 75.23 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34	

Average = Sum(39)1…12 /12= | 112.65 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39	

Average = Sum(40)1…12 /12= | 1.38 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	

Total = Sum(44)1…12 = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	

Total = Sum(45)1…12 = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ — 1617.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	378.05	375.99	362.4	340.44	318.11	296.58	282.58	288.55	299.82	321.99	347.48	366.64	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	616.05	813.44	1032.4	1268.03	1429.82	1427.93	1362.12	1229.35	1060.31	826.06	638.72	566.14	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.67	0.49	0.36	0.41	0.67	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.86	20.26	20.67	20.9	20.98	21	20.99	20.93	20.55	19.96	19.52	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.8	0.6	0.4	0.26	0.31	0.57	0.89	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.9	18.31	18.88	19.43	19.7	19.78	19.79	19.79	19.74	19.3	18.48	17.83	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.27	18.66	19.19	19.71	19.97	20.05	20.06	20.06	20.01	19.58	18.81	18.21	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(93)m=	18.12	18.51	19.04	19.56	19.82	19.9	19.91	19.91	19.86	19.43	18.66	18.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.6	0.41	0.27	0.32	0.58	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	609.46	788.71	946.36	1002.19	861.37	583.03	367.78	388.52	612.95	726.66	623.73	561.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1580.3	1552.27	1426.98	1201.04	912.73	590.27	368.65	390.24	643.49	992.87	1304.82	1570.68	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	722.3	513.11	357.58	143.17	38.21	0	0	0	0	198.06	490.38	750.64	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3213.46 (98)

Space heating requirement in kWh/m²/year 39.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	722.3	513.11	357.58	143.17	38.21	0	0	0	0	198.06	490.38	750.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	803.45	570.76	397.75	159.26	42.5	0	0	0	0	220.31	545.48	834.97	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3574.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	
Efficiency of water heater												87.3	(216)
(217)m=	89.41	89.32	89.12	88.63	87.89	87.3	87.3	87.3	87.3	88.82	89.28	89.43	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	184.47	161.91	168.41	148.99	145.2	127.66	119.79	135.32	136.3	154.31	165.81	179.04	

Total = Sum(219a)$_{1...12}$ = 1827.23 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3574.49

Water heating fuel used		1827.23	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		350.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		5914.4	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	772.09	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	394.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1166.77	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	181.85	(268)
Total CO2, kg/year			sum of (265)…(271) =		1387.55	(272)
Dwelling CO2 Emission Rate			(272) ÷ (4) =		17.03	(273)
EI rating (section 14)					85	(274)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 2			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 3			5.12	x1/[1/(1.4)+ 0.04]		=	6.79			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Rooflights Type 1			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 2			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 3			0.9264612	x1/[1/(1.7) + 0.04]		=	1.574984			(27b)
Rooflights Type 4			0.6569452	x1/[1/(1.7) + 0.04]		=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21843.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 13.06 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 69.82 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63	

Average = $Sum(39)_{1...12}$ /12= | 108.73 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35

Average = $Sum(40)_{1...12}$ /12= | 1.33 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = $Sum(44)_{1...12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = $Sum(45)_{1...12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.55	48.52	45.12	44.72	41.43	42.82	44.72	45.12	48.52	48.8	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	

Output from water heater (annual)$_{1...12}$ | 2026.06 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63.37	55.67	57.83	51.12	49.41	43.35	41.27	46.26	46.78	53.5	57.36	61.78	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	85.18	82.85	77.73	71	66.41	60.2	55.47	62.17	64.97	71.91	79.66	83.03	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	390.93	388.68	374.46	351.86	328.89	306.72	292.72	299.33	311.24	334.05	360.18	379.51	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	566.2	710.84	867.85	1034.91	1147.5	1139.79	1087.64	992.1	871.25	705.25	574.66	526.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.58	0.43	0.48	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.8	20.16	20.57	20.85	20.97	20.99	20.99	20.9	20.49	19.95	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.87	0.7	0.48	0.32	0.37	0.66	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.92	18.26	18.77	19.34	19.68	19.81	19.83	19.83	19.75	19.25	18.48	17.87	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

TER WorkSheet: New dwelling design stage

(93)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.98	0.95	0.86	0.7	0.5	0.34	0.39	0.67	0.92	0.98	0.99		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	561.93	697.24	823.49	892.3	807.5	571.53	371.78	390.52	585.48	649.07	565.56	523.49		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1551.47	1515.52	1386.84	1165.56	894.17	585.94	373.75	394.17	636	968.46	1276.32	1539.8		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14		
Total per year (kWh/year) = Sum(98)1...5,9...12 =													3471.98	(98)
Space heating requirement in kWh/m²/year													42.6	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	788.24	588.74	448.75	210.65	69.05	0	0	0	0	254.42	547.91	809.57		
Total (kWh/year) =Sum(211)1...5,10...12=													3717.33	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)1...5,10...12=													0	(215)
Water heating														
Output from water heater (calculated above)														
	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44		
Efficiency of water heater													80.3	(216)
(217)m=	88.01	87.69	87.04	85.5	82.97	80.3	80.3	80.3	80.3	85.85	87.48	88.1		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.95	203.82	213.66	192.92	192.48	175.15	167.81	187.07	189.13	201.44	211.02	225.25		
Total = Sum(219a)1...12 =													2390.71	(219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3717.33

TER WorkSheet: New dwelling design stage

Water heating fuel used			2390.71	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			350.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6613.72	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	802.94	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	516.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1319.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	181.85	(268)
Total CO2, kg/year			sum of (265)…(271) =		1540.11	(272)

TER = 18.9 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE C - IMPROVED

Dwelling type:	Detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	520.69	**(P1)**
Transmission heat loss coefficient:	75.2	
Summer heat loss coefficient:	595.92	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W1-3 FRONT)	0	1
North (W4 - SIDE N)	0	1
South (W5 - SIDE S)	0	1
East (W6 - REAR E)	0	1
West (RW1-2 FRONT W)	0	1
East (RW3-4 REAR E)	0	1
East (RW5 REAR E)	0	1
East (RW6 REAR E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W1-3 FRONT)	0.98	1	1	0.98	**(P8)**
North (W4 - SIDE N)	0.98	1	1	0.98	**(P8)**
South (W5 - SIDE S)	0.98	1	1	0.98	**(P8)**
East (W6 - REAR E)	0.98	1	1	0.98	**(P8)**
West (RW1-2 FRONT W)	0.98	1	1	0.98	**(P8)**
East (RW3-4 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW5 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW6 REAR E)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
West (W1-3 FRONT)	1 x	4.86	124.8	0.63	0.8	0.98	270.99
North (W4 - SIDE N)	1 x	1.62	86.66	0.63	0.8	0.98	62.72
South (W5 - SIDE S)	1 x	6.08	118.4	0.63	0.8	0.98	321.63
East (W6 - REAR E)	1 x	2.14	124.8	0.63	0.8	0.98	119.32
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	1.1	187.8	0.63	0.8	0.98	92.3
	1 x	0.78	187.8	0.63	0.8	0.98	65.45

SAP 2012 Overheating Assessment

		Total	1378.81 **(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	432.58	414.57	422.73	
Total summer gains	1893.39	1793.39	1640.4	**(P5)**
Summer gain/loss ratio	3.18	3.01	2.75	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	18.83	20.66	20.5	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:54

Project Information:

Assessed By:	Jemma Mclaughlan (STRO030065)	**Building Type:**	Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 78.4m²	
Site Reference :	WOODWELL	**Plot Reference:**	HOUSE D - IMPROVED
Address :	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU		

Client Details:

Name:
Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.36 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.0 kWh/m²	
		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	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	OK
Based on:		
Overshading:	Average or unknown	
Windows facing: North	3.24m²	
Windows facing: West	2.59m²	
Windows facing: West	0.86m²	
Windows facing: South	2.14m²	
Roof windows facing: South	2.66m²	
Ventilation rate:	8.00	
Blinds/curtains:	Dark-coloured curtain or roller blind	
	Closed 10% of daylight hours	

10 Key features

Party Walls U-value	0 W/m²K

Thermal Bridge Report

Property Details: HOUSE D - IMPROVED

Address: Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in: England
Region: South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

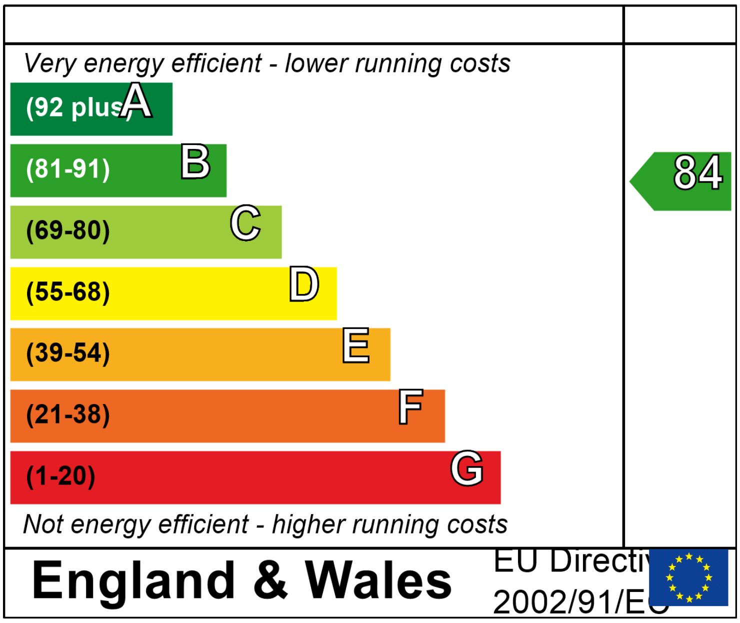
Predicted Energy Assessment

Woodwell Cottage P2 Woodwell Road BRISTOL BS11 9XU	Dwelling type: Date of assessment: Produced by: Total floor area:	Semi-detached House 24 February 2021 Jemma Mclaughlan 78.4 m²

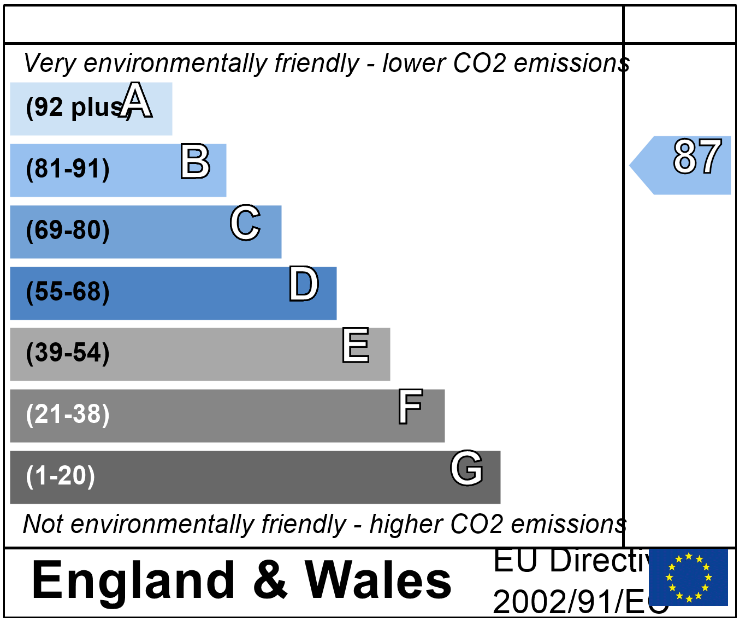
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE D - IMPROVED

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m

Living area:	18.35 m² (fraction 0.234)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.3	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	West	0	0
W4 - SIDE E		EXTERNAL WALLS	West	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading:	Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	80.83	10.9	69.93	0.2	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.2	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.14	0	N/A
GROUND FLOOR	39.2			0.17		N/A
<u>Internal Elements</u>						
<u>Party Elements</u>						
PARTY WALL	29.73					N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26

Average = $Sum(39)_{1...12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22

Average = $Sum(40)_{1...12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = $Sum(44)_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = $Sum(45)_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)1…12 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	48.45	43.03	35	26.5	19.81	16.72	18.07	23.48	31.52	40.02	46.71	49.8	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	545.88	541.68	520.8	488.35	455.11	425.24	407.7	415.74	434.33	466.99	503.35	530.88	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
West	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(80)
West	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(80)
West	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(80)
West	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(80)
West	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(80)
West	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(80)
West	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(80)
West	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(80)
West	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(80)
West	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(80)
West	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(80)
West	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(80)

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West	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(80)
West	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(80)
West	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(80)
West	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(80)
West	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(80)
West	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(80)
West	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(80)
West	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(80)
West	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(80)
West	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(80)
West	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(80)
West	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	694.35	807.23	913.32	1016.43	1079.49	1058.18	1012.58	947.7	874.11	768.77	683.59	656.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.55	0.4	0.45	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.11	20.38	20.7	20.9	20.98	21	20.99	20.94	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.46	0.31	0.35	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.49	18.77	19.16	19.58	19.83	19.91	19.92	19.92	19.88	19.56	18.96	18.44		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.82	19.08	19.45	19.84	20.08	20.16	20.17	20.17	20.13	19.82	19.25	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.93	19.3	19.69	19.93	20.01	20.02	20.02	19.98	19.67	19.1	18.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.67	0.47	0.32	0.36	0.61	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	681.18	777.68	843.63	844.46	725.3	499.3	319.77	337.28	529.06	669.23	659.06	646.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.46	1345.57	1224.39	1021.91	777.3	506.67	320.58	338.71	552.48	857	1138.76	1374.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2378.94 (98)

Space heating requirement in kWh/m²/year 30.34 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	579.54	424.49	315.1	142.12	43.04	0	0	0	0	155.4	384.18	602.34	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2646.21 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

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(217)m=	89.27	89.18	88.99	88.57	87.9	87.3	87.3	87.3	87.3	88.6	89.11	89.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.2	159.92	166.33	147.07	143.22	125.96	118.21	133.51	134.47	152.58	163.85	176.83

Total = Sum(219a)$_{1...12}$ = 1804.16 (219)

Annual totals		kWh/year	kWh/year	
Space heating fuel used, main system 1			2646.21	
Water heating fuel used			1804.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4954.94	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year		**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211)	x	3.48	x 0.01 =	92.09	(240)
Space heating - main system 2	(213)	x	0	x 0.01 =	0	(241)
Space heating - secondary	(215)	x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)		3.48	x 0.01 =	62.78	(247)
Pumps, fans and electric keep-hot	(231)		13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)		13.19	x 0.01 =	45.14	(250)
Additional standing charges (Table 12)					120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 329.91 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.12	(257)
SAP rating (Section 12)		84.34	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	571.58	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	389.7	(264)

Space and water heating	(261) + (262) + (263) + (264) =			961.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1177.84	(272)
CO2 emissions per m²		(272) ÷ (4) =		15.02	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3228.38	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2201.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5429.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1050.75	(268)
‘Total Primary Energy		sum of (265)…(271) =		6710.46	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		85.59	(273)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)$_{1...12}$ /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)$_{1...12}$ /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ | 1229.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 478.84 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 119.71 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.53 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.48 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 57.1 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)1…12 /12= 94.67 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22

Average = Sum(40)1…12 /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = 1103.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1…12 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.58	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.84	20.13	20.49	20.79	20.95	20.99	20.98	20.87	20.47	19.99	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.68	18.86	19.15	19.51	19.78	19.9	19.92	19.92	19.85	19.49	19.02	18.65	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.91	559.64	645.43	702.3	663.96	495.8	331.09	346.46	495.49	522.92	461.4	434.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1403.7	1360.91	1232.49	1026.55	785.58	519.2	334.35	352.26	562.54	861.83	1152.19	1398.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.2	538.46	436.77	233.46	90.48	0	0	0	0	252.16	497.37	717.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3465.06 (98)

Space heating requirement in kWh/m²/year 44.2 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	879.9	692.69	710.17	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.88	0.93	0.91	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.09	645.44	645.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	160.76	228.36	182.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 571.39 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	40.19	57.09	45.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 142.85 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.82 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.02	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.2	(1a) x	2.6	(2a) =	101.92	(3a)
First floor	39.2	(1b) x	2.56	(2b) =	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1…12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1…12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	369.58	367.49	354.15	332.66	310.86	289.85	276.2	282.14	293.19	314.89	339.81	358.48	(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	496.95	595.24	690.45	784.17	843.63	829.4	792.06	736.58	669.7	573.65	494.43	466.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.51	0.57	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.87	20.16	20.52	20.8	20.95	20.99	20.98	20.88	20.49	20.02	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.58	0.39	0.44	0.74	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.16	18.43	18.85	19.36	19.73	19.89	19.92	19.92	19.83	19.34	18.65	18.12		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.52	18.77	19.16	19.63	19.98	20.14	20.17	20.17	20.07	19.61	18.97	18.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.37	18.62	19.01	19.48	19.83	19.99	20.02	20.02	19.92	19.46	18.82	18.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.4	0.45	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	494.31	587.84	668.62	715.59	664.63	486.21	317.96	334.07	493.16	541.06	488.89	464.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1352.22	1315.64	1196.57	1001.74	768.2	504.73	320.28	338.19	547.11	836.81	1112.17	1345.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3128.06 (98)

Space heating requirement in kWh/m²/year 39.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	710	544.03	436.92	229.17	85.71	0	0	0	0	244.76	499.18	729.72	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3479.49 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

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(217)m=	89.36	89.3	89.17	88.87	88.27	87.3	87.3	87.3	87.3	88.89	89.25	89.38	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.01	159.7	165.99	146.57	142.62	125.96	118.21	133.51	134.47	152.09	163.6	176.67	

Total = $Sum(219a)_{1...12}$ = 1801.39 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3479.49	
Water heating fuel used			1801.39	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			348.92	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5792.1	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	751.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1140.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.09	(268)
Total CO2, kg/year		sum of (265)…(271) =		1360.68	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.36	(273)
EI rating (section 14)				85	(274)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 2			2.59		x1/[1/(1.4)+ 0.04]	=	3.43			(27)
Windows Type 3			0.86		x1/[1/(1.4)+ 0.04]	=	1.14			(27)
Windows Type 4			2.14		x1/[1/(1.4)+ 0.04]	=	2.84			(27)
Rooflights			1.33		x1/[1/(1.7) + 0.04]	=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	43.19	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23461.84	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37

Average = Sum(39)$_{1...12}$ /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)$_{1...12}$ /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)1…12 1997.22 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3173.97 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3398.26 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23

Efficiency of water heater 80.3 (216)

TER WorkSheet: New dwelling design stage

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4

	Total = Sum(219a)$_{1...12}$ =	2356.83	(219)
Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3398.26	
Water heating fuel used		2356.83	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE D - IMPROVED

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	57.1	
Summer heat loss coefficient:	591.1	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
West (W3 - SIDE E)	0	1
West (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
West (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
West (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
West (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
West (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	422.24	404.7	412.74	
Total summer gains	1133.38	1076.17	1007.8	**(P5)**
Summer gain/loss ratio	1.92	1.82	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.57	19.47	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:51

Project Information:

Assessed By: Jemma Mclaughlan (STRO030065) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.4m²

Site Reference : WOODWELL **Plot Reference:** HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

Client Details:

Name:

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.36 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.0 kWh/m²	
		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	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system: Database: (rev 472, product index 017179):
Boiler systems with radiators or underfloor heating - mains gas
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi)
Efficiency 89.0 % SEDBUK2009
Minimum 88.0 % OK

Secondary heating system: None

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	**OK**
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	3.24m²
Windows facing: East	2.59m²
Windows facing: East	0.86m²
Windows facing: South	2.14m²
Roof windows facing: South	2.66m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

Party Walls U-value	0 W/m²K

Thermal Bridge Report

Property Details: HOUSE E - IMPROVED

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

Predicted Energy Assessment

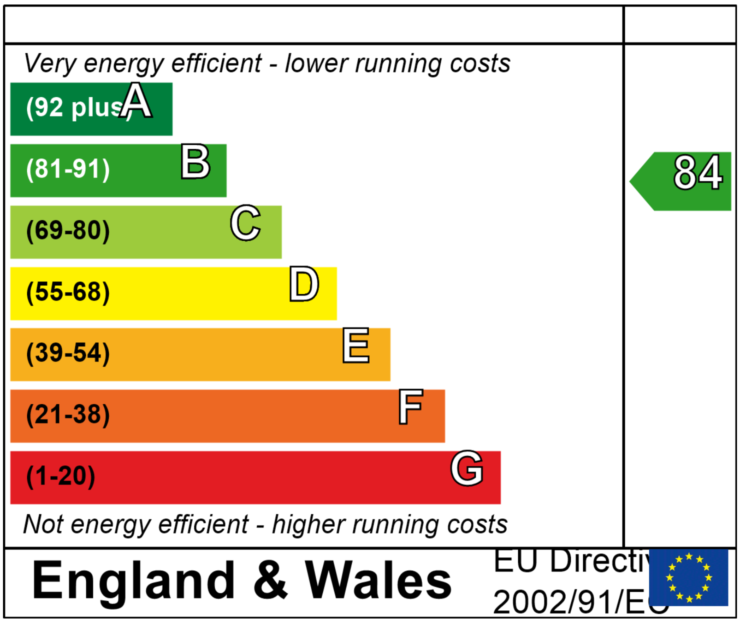
Woodwell Cottage P2
Woodwell Road
BRISTOL
BS11 9XU

Dwelling type: Semi-detached House
Date of assessment: 24 February 2021
Produced by: Jemma Mclaughlan
Total floor area: 78.4 m²

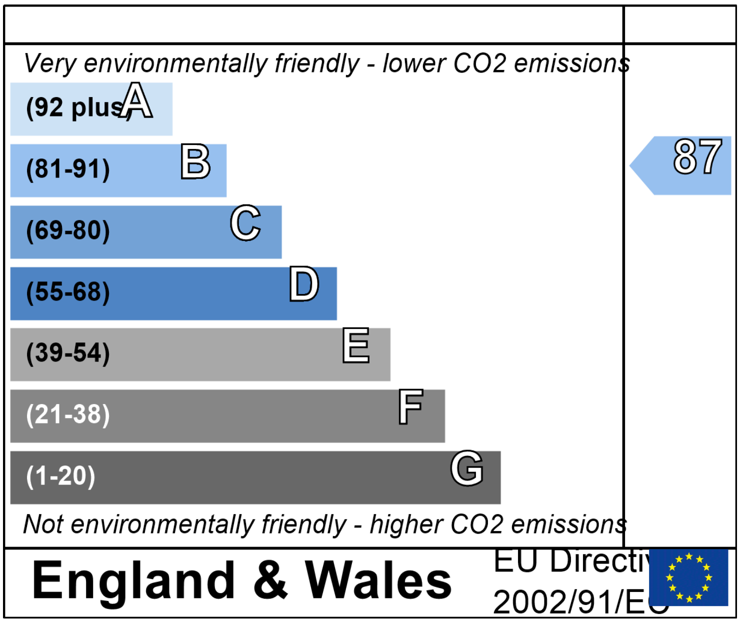
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

SAP Input

Property Details: HOUSE E - IMPROVED

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m

Living area:	18.35 m² (fraction 0.234)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.3	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	East	0	0
W4 - SIDE E		EXTERNAL WALLS	East	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	80.83	10.9	69.93	0.2	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.2	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.14	0	N/A
GROUND FLOOR	39.2			0.17		N/A
Internal Elements						
Party Elements						
PARTY WALL	29.73					N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:

Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:

Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	None
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1...12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1...12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

SAP WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ — 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	48.45	43.03	35	26.5	19.81	16.72	18.07	23.48	31.52	40.02	46.71	49.8	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	545.88	541.68	520.8	488.35	455.11	425.24	407.7	415.74	434.33	466.99	503.35	530.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
East	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(76)
East	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(76)
East	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(76)
East	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(76)
East	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(76)
East	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(76)
East	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(76)
East	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(76)
East	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(76)
East	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(76)
East	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(76)
East	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(76)
East	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(76)
East	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(76)
East	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(76)
East	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(76)
East	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(76)
East	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(76)
East	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(76)
East	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(76)
East	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(76)
East	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(76)
East	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(76)
East	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(76)

South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	694.35	807.23	913.32	1016.43	1079.49	1058.18	1012.58	947.7	874.11	768.77	683.59	656.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.55	0.4	0.45	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.11	20.38	20.7	20.9	20.98	21	20.99	20.94	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.46	0.31	0.35	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.77	19.16	19.58	19.83	19.91	19.92	19.92	19.88	19.56	18.96	18.44	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.82	19.08	19.45	19.84	20.08	20.16	20.17	20.17	20.13	19.82	19.25	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.93	19.3	19.69	19.93	20.01	20.02	20.02	19.98	19.67	19.1	18.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.67	0.47	0.32	0.36	0.61	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	681.18	777.68	843.63	844.46	725.3	499.3	319.77	337.28	529.06	669.23	659.06	646.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.46	1345.57	1224.39	1021.91	777.3	506.67	320.58	338.71	552.48	857	1138.76	1374.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2378.94 (98)

Space heating requirement in kWh/m²/year 30.34 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	579.54	424.49	315.1	142.12	43.04	0	0	0	0	155.4	384.18	602.34	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2646.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.27	89.18	88.99	88.57	87.9	87.3	87.3	87.3	87.3	88.6	89.11	89.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.2	159.92	166.33	147.07	143.22	125.96	118.21	133.51	134.47	152.58	163.85	176.83	

Total = Sum(219a)$_{1...12}$ = 1804.16 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2646.21	
Water heating fuel used			1804.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.26	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4954.94	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	92.09	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.78	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	45.14	(250)
Additional standing charges (Table 12)				120	(251)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 329.91 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	1.12	(257)
SAP rating (Section 12)		84.34	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	571.58	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.7	(264)

Space and water heating	(261) + (262) + (263) + (264) =			961.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.63	(268)
Total CO2, kg/year		sum of (265)…(271) =		1177.84	(272)
CO2 emissions per m²		(272) ÷ (4) =		15.02	(273)
EI rating (section 14)				87	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3228.38	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2201.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5429.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1050.75	(268)
'Total Primary Energy		sum of (265)…(271) =		6710.46	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		85.59	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)$_{1…12}$ /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)$_{1…12}$ /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ | 1229.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

TFEE WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0	

Total = Sum(104)6...8 = 478.84 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)6...8 = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)6...8 = 119.71 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.53 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1…12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1…12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1…12 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

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South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.58	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.84	20.13	20.49	20.79	20.95	20.99	20.98	20.87	20.47	19.99	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.68	18.86	19.15	19.51	19.78	19.9	19.92	19.92	19.85	19.49	19.02	18.65	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.91	559.64	645.43	702.3	663.96	495.8	331.09	346.46	495.49	522.92	461.4	434.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1403.7	1360.91	1232.49	1026.55	785.58	519.2	334.35	352.26	562.54	861.83	1152.19	1398.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.2	538.46	436.77	233.46	90.48	0	0	0	0	252.16	497.37	717.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3465.06 (98)

Space heating requirement in kWh/m²/year 44.2 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	879.9	692.69	710.17	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.88	0.93	0.91	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.09	645.44	645.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	160.76	228.36	182.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 571.39 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	40.19	57.09	45.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 142.85 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.82 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.02	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1...12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)$_{1...12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ — 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	369.58	367.49	354.15	332.66	310.86	289.85	276.2	282.14	293.19	314.89	339.81	358.48	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	496.95	595.24	690.45	784.17	843.63	829.4	792.06	736.58	669.7	573.65	494.43	466.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.51	0.57	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.87	20.16	20.52	20.8	20.95	20.99	20.98	20.88	20.49	20.02	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.58	0.39	0.44	0.74	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.16	18.43	18.85	19.36	19.73	19.89	19.92	19.92	19.83	19.34	18.65	18.12		(90)
										fLA = Living area ÷ (4) =			0.23	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.52	18.77	19.16	19.63	19.98	20.14	20.17	20.17	20.07	19.61	18.97	18.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.37	18.62	19.01	19.48	19.83	19.99	20.02	20.02	19.92	19.46	18.82	18.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation factor for gains, hm:														
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.4	0.45	0.74	0.94	0.99	1		(94)
Useful gains, hmGm , W = (94)m x (84)m														
(95)m=	494.31	587.84	668.62	715.59	664.63	486.21	317.96	334.07	493.16	541.06	488.89	464.24		(95)
Monthly average external temperature from Table 8														
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2		(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]														
(97)m=	1352.22	1315.64	1196.57	1001.74	768.2	504.73	320.28	338.19	547.11	836.81	1112.17	1345.98		(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m														
(98)m=	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02		
									Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =				3128.06	(98)
Space heating requirement in kWh/m²/year													39.9	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	710	544.03	436.92	229.17	85.71	0	0	0	0	244.76	499.18	729.72		
									Total (kWh/year) =Sum(211)$_{1...5,10....12}$=				3479.49	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
									Total (kWh/year) =Sum(215)$_{1...5,10....12}$=				0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91		
Efficiency of water heater													87.3	(216)

(217)m=	89.36	89.3	89.17	88.87	88.27	87.3	87.3	87.3	87.3	88.89	89.25	89.38	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.01	159.7	165.99	146.57	142.62	125.96	118.21	133.51	134.47	152.09	163.6	176.67	

Total = Sum(219a)$_{1...12}$ = 1801.39 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3479.49	
Water heating fuel used			1801.39	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			348.92	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			5792.1	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	751.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1140.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.09	(268)
Total CO2, kg/year		sum of (265)…(271) =		1360.68	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		17.36	(273)
EI rating (section 14)				85	(274)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - IMPROVED

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.55 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 53.74 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= 92.59 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)1…12 /12= 1.18 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)1…12 = 1103.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)1…12 = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)1…12 | 1997.22 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3173.97 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3398.26 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23

Efficiency of water heater 80.3 (216)

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4

Total = Sum(219a)$_{1...12}$ = 2356.83 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3398.26	
Water heating fuel used			2356.83	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE E - IMPROVED

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	57.1	
Summer heat loss coefficient:	591.1	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
East (W3 - SIDE E)	0	1
East (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
East (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
East (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
East (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
East (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	422.24	404.7	412.74	
Total summer gains	1133.38	1076.17	1007.8	**(P5)**
Summer gain/loss ratio	1.92	1.82	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.57	19.47	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

APPENDIX D: SAP Calculation Worksheets – IMPROVED (BE GREEN)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:47

Project Information:

Assessed By:	Jemma Mclaughlan (STRO030065)	**Building Type:**	Detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE		Total Floor Area: 81.5m²	
Site Reference :	WOODWELL	**Plot Reference:**	HOUSE C - FINAL
Address :	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU		

Client Details:

Name:
Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.9 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.11 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	57.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	48.2 kWh/m²	
		OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.20 (max. 0.30)	0.20 (max. 0.70)	**OK**
Floor	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat	
	No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Slight	OK

Based on:

Overshading:	Average or unknown
Windows facing: West	4.86m²
Windows facing: North	1.62m²
Windows facing: South	6.08m²
Windows facing: East	2.14m²
Roof windows facing: West	2.66m²
Roof windows facing: East	2.66m²
Roof windows facing: East	1.1m²
Roof windows facing: East	0.78m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind
	Closed 10% of daylight hours

10 Key features

Photovoltaic array

Thermal Bridge Report

Property Details: HOUSE C - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0578

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	9.97	E2	[UD]
Sill	0.04	5.4	E3	[A]
Jamb	0.05	22.8	E4	[A]
Ground floor (normal)	0.08	25.7	E5	[UD]
Intermediate floor within a dwelling	0.07	25.7	E6	[A]
Eaves (insulation at rafter level)	0.04	15.65	E11	[A]
Gable (insulation at rafter level)	0.04	19.28	E13	[A]
Corner (normal)	0.09	15.8	E16	[A]

Roof Junctions Details:

Head	0.08	9.47	R1	[D]
Sill	0.06	9.47	R2	[D]
Jamb	0.08	17.2	R3	[D]
Ridge (vaulted ceiling)	0.08	9.3	R4	[D]

SAP Input

Property Details: HOUSE C - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	40.75 m²	2.6 m
Floor 1	40.75 m²	2.24 m

Living area:	18.3 m² (fraction 0.225)
Front of dwelling faces:	West

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-3 FRONT	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - SIDE S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W6 - REAR E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 FRONT W	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW3-4 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW5 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal
RW6 REAR E	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	1.93	1
W1-3 FRONT	16mm or more	0.8	0.63	1.4	1.62	3
W4 - SIDE N	16mm or more	0.8	0.63	1.4	1.62	1
W5 - SIDE S	16mm or more	0.8	0.63	1.4	6.08	1
W6 - REAR E	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 FRONT W	16mm or more	0.8	0.63	1.3	1.33	2
RW3-4 REAR E	16mm or more	0.8	0.63	1.3	1.33	2
RW5 REAR E	16mm or more	0.8	0.63	1.3	1.1	1
RW6 REAR E	16mm or more	0.8	0.63	1.3	0.78	1

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	West	0	0
W1-3 FRONT		EXTERNAL WALLS	West	0	0
W4 - SIDE N		EXTERNAL WALLS	North	0	0
W5 - SIDE S		EXTERNAL WALLS	South	0	0
W6 - REAR E		EXTERNAL WALLS	East	0	0
RW1-2 FRONT W		ROOF	West	0.001	0

SAP Input

RW3-4 REAR E	ROOF	East	0.001	0
RW5 REAR E	ROOF	East	0.001	0
RW6 REAR E	ROOF	East	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	102.95	16.63	86.32	0.2	0	False	N/A
DORMER CHEEKS	2	0	2	0.2	0	False	N/A
ROOF	61.3	7.2	54.1	0.14	0		N/A
GROUND FLOOR	40.75			0.17			N/A
Internal Elements							
Party Elements							

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0578

	Length	Psi-value		
	9.97	0.05	E2	Other lintels (including other steel lintels)
[Approved]	5.4	0.04	E3	Sill
[Approved]	22.8	0.05	E4	Jamb
	25.7	0.08	E5	Ground floor (normal)
[Approved]	25.7	0.07	E6	Intermediate floor within a dwelling
[Approved]	15.65	0.04	E11	Eaves (insulation at rafter level)
[Approved]	19.28	0.04	E13	Gable (insulation at rafter level)
[Approved]	15.8	0.09	E16	Corner (normal)
	9.47	0.08	R1	Head
	9.47	0.06	R2	Sill
	17.2	0.08	R3	Jamb
	9.3	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	0
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open

SAP Input

	Boiler interlock: Yes Delayed start
Main heating Control:	
Main heating Control:	Time and temperature zone control by suitable arrangement of plumbing and electrical services Control code: 2110
Secondary heating system:	
Secondary heating system:	None
Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False
Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.36 Tilt of collector: 45° Overshading: None or very little Collector Orientation: East
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 2			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 3			1.1	x1/[1/(1.3) + 0.04]		=	1.43			(27b)
Rooflights Type 4			0.78	x1/[1/(1.3) + 0.04]		=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 11.97 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 75.23 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34

Average = Sum(39)$_{1...12}$ /12= | 112.65 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39

Average = Sum(40)$_{1...12}$ /12= | 1.38 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)$_{1...12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)$_{1...12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ 1617.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	149.44	(66)

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

(67)m=	49.6	44.05	35.83	27.12	20.28	17.12	18.5	24.04	32.27	40.97	47.82	50.98	(67)

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

(68)m=	332.16	335.61	326.92	308.43	285.09	263.15	248.49	245.05	253.73	272.22	295.57	317.5	(68)

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

(69)m=	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	52.43	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	559.31	555.06	533.67	500.39	466.24	435.58	417.57	425.73	444.8	478.3	515.6	543.89	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	7.81	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	14.93	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	25.37	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	40.76	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	54.9	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	58.78	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	54.87	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	43.54	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	30.51	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	17.78	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	9.64	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	6.51	(74)
East	0.9x	1	x	2.14	x	19.64	x	0.63	x	0.8	=	19.06	(76)
East	0.9x	1	x	2.14	x	38.42	x	0.63	x	0.8	=	37.29	(76)
East	0.9x	1	x	2.14	x	63.27	x	0.63	x	0.8	=	61.42	(76)
East	0.9x	1	x	2.14	x	92.28	x	0.63	x	0.8	=	89.58	(76)
East	0.9x	1	x	2.14	x	113.09	x	0.63	x	0.8	=	109.78	(76)
East	0.9x	1	x	2.14	x	115.77	x	0.63	x	0.8	=	112.38	(76)
East	0.9x	1	x	2.14	x	110.22	x	0.63	x	0.8	=	106.99	(76)
East	0.9x	1	x	2.14	x	94.68	x	0.63	x	0.8	=	91.9	(76)
East	0.9x	1	x	2.14	x	73.59	x	0.63	x	0.8	=	71.43	(76)
East	0.9x	1	x	2.14	x	45.59	x	0.63	x	0.8	=	44.25	(76)
East	0.9x	1	x	2.14	x	24.49	x	0.63	x	0.8	=	23.77	(76)
East	0.9x	1	x	2.14	x	16.15	x	0.63	x	0.8	=	15.68	(76)
South	0.9x	1	x	6.08	x	46.75	x	0.63	x	0.8	=	128.94	(78)
South	0.9x	1	x	6.08	x	76.57	x	0.63	x	0.8	=	211.17	(78)
South	0.9x	1	x	6.08	x	97.53	x	0.63	x	0.8	=	268.99	(78)
South	0.9x	1	x	6.08	x	110.23	x	0.63	x	0.8	=	304.01	(78)
South	0.9x	1	x	6.08	x	114.87	x	0.63	x	0.8	=	316.8	(78)
South	0.9x	1	x	6.08	x	110.55	x	0.63	x	0.8	=	304.88	(78)
South	0.9x	1	x	6.08	x	108.01	x	0.63	x	0.8	=	297.88	(78)
South	0.9x	1	x	6.08	x	104.89	x	0.63	x	0.8	=	289.29	(78)
South	0.9x	1	x	6.08	x	101.89	x	0.63	x	0.8	=	280.99	(78)
South	0.9x	1	x	6.08	x	82.59	x	0.63	x	0.8	=	227.76	(78)
South	0.9x	1	x	6.08	x	55.42	x	0.63	x	0.8	=	152.83	(78)
South	0.9x	1	x	6.08	x	40.4	x	0.63	x	0.8	=	111.41	(78)

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West	0.9x	1	x	1.62	x	19.64	x	0.63	x	0.8	=	43.3	(80)
West	0.9x	1	x	1.62	x	38.42	x	0.63	x	0.8	=	84.7	(80)
West	0.9x	1	x	1.62	x	63.27	x	0.63	x	0.8	=	139.49	(80)
West	0.9x	1	x	1.62	x	92.28	x	0.63	x	0.8	=	203.43	(80)
West	0.9x	1	x	1.62	x	113.09	x	0.63	x	0.8	=	249.31	(80)
West	0.9x	1	x	1.62	x	115.77	x	0.63	x	0.8	=	255.22	(80)
West	0.9x	1	x	1.62	x	110.22	x	0.63	x	0.8	=	242.98	(80)
West	0.9x	1	x	1.62	x	94.68	x	0.63	x	0.8	=	208.71	(80)
West	0.9x	1	x	1.62	x	73.59	x	0.63	x	0.8	=	162.23	(80)
West	0.9x	1	x	1.62	x	45.59	x	0.63	x	0.8	=	100.5	(80)
West	0.9x	1	x	1.62	x	24.49	x	0.63	x	0.8	=	53.99	(80)
West	0.9x	1	x	1.62	x	16.15	x	0.63	x	0.8	=	35.61	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	283.79	517.51	783.91	1074.27	1279.79	1299.53	1241.16	1086.49	885.88	593.84	346.49	238.42	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	843.11	1072.57	1317.58	1574.66	1746.04	1735.11	1658.74	1512.22	1330.68	1072.13	862.09	782.31	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.98	0.96	0.89	0.75	0.57	0.41	0.29	0.34	0.56	0.85	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.81	20.11	20.47	20.8	20.95	20.99	21	21	20.97	20.71	20.19	19.75	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.98	0.94	0.86	0.7	0.51	0.33	0.21	0.25	0.47	0.8	0.95	0.98	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.24	18.66	19.16	19.58	19.74	19.78	19.79	19.79	19.76	19.49	18.79	18.16	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.59	18.99	19.46	19.85	20.01	20.05	20.06	20.06	20.03	19.77	19.1	18.52	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.44	18.84	19.31	19.7	19.86	19.9	19.91	19.91	19.88	19.62	18.95	18.37	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.97	0.93	0.85	0.7	0.51	0.34	0.22	0.26	0.48	0.79	0.94	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	817.77	999.45	1120.57	1096.36	890.05	587.53	368.37	389.7	632.15	846.78	811.82	764.08	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1616.85	1589.68	1457.8	1216.79	917.29	591	368.76	390.45	646.59	1013.68	1337.86	1605.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	594.51	396.63	250.9	86.71	20.27	0	0	0	0	124.18	378.75	626.24	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2478.19 (98)

Space heating requirement in kWh/m²/year 30.41 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	594.51	396.63	250.9	86.71	20.27	0	0	0	0	124.18	378.75	626.24	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	661.3	441.2	279.09	96.45	22.55	0	0	0	0	138.13	421.3	696.6	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2756.61 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	
Efficiency of water heater												87.3	(216)
(217)m=	89.32	89.19	88.91	88.31	87.65	87.3	87.3	87.3	87.3	88.52	89.15	89.36	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	184.64	162.13	168.8	149.53	145.6	127.66	119.79	135.32	136.3	154.84	166.05	179.19	

Total = Sum(219a)$_{1...12}$ = 1829.87 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2756.61

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Water heating fuel used			1829.87	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			350.38	(232)
Electricity generated by PVs			-928.1	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4171.07	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	95.93	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	63.68	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	46.22	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-122.42	(252)
Appendix Q items: repeat lines (253) and (254) as needed					
Total energy cost	(245)...(247) + (250)…(254) =			213.3	(255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.71	(257)
SAP rating (Section 12)		90.12	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	595.43	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	395.25	(264)
Space and water heating	(261) + (262) + (263) + (264) =			990.68	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.85	(268)

Energy saving/generation technologies

Item 1		0.519	=	-481.68	(269)
Total CO2, kg/year	sum of (265)…(271) =			729.77	(272)
CO2 emissions per m²	(272) ÷ (4) =			8.95	(273)
EI rating (section 14)				92	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3363.07	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2232.44	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5595.5	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1075.68	(268)
Energy saving/generation technologies					
Item 1		3.07	=	-2849.26	(269)
‘Total Primary Energy	sum of (265)…(271) =			4052.18	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			49.72	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 2			1.36	x1/[1/(1.4)+ 0.04]		=	1.8			(27)
Windows Type 3			5.12	x1/[1/(1.4)+ 0.04]		=	6.79			(27)
Windows Type 4			1.8	x1/[1/(1.4)+ 0.04]		=	2.39			(27)
Rooflights Type 1			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 2			1.120176	x1/[1/(1.7) + 0.04]		=	1.904299			(27b)
Rooflights Type 3			0.9264612	x1/[1/(1.7) + 0.04]		=	1.574984			(27b)
Rooflights Type 4			0.6569452	x1/[1/(1.7) + 0.04]		=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21843.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 13.06 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 69.82 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63

Average = Sum(39)1…12 /12= 108.73 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35

Average = Sum(40)1…12 /12= 1.33 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.49 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 93.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = Sum(44)1…12 = 1120.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = Sum(45)1…12 = 1468.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)1…12 1248.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	521.52	667.11	826.37	996.27	1110.93	1105.86	1055.43	957.06	834.8	665.88	532.08	482.53	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.91	0.78	0.59	0.44	0.5	0.77	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.52	19.76	20.12	20.54	20.84	20.96	20.99	20.99	20.89	20.45	19.9	19.49	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.88	0.71	0.49	0.33	0.38	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.46	18.7	19.06	19.47	19.72	19.82	19.83	19.83	19.77	19.4	18.85	18.44	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.7	18.94	19.29	19.71	19.97	20.07	20.09	20.09	20.02	19.64	19.09	18.67	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.96	0.88	0.72	0.52	0.35	0.41	0.69	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	518.97	657.85	792.33	874.48	800.81	570.14	371.55	390.01	579.41	622.9	526.31	480.83	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1597.31	1552.34	1410.64	1175.48	896.69	586.24	373.77	394.2	637.07	979.96	1307.18	1586.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	802.29	601.1	460.02	216.72	71.33	0	0	0	0	265.65	562.23	822.74	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3802.08 (98)

Space heating requirement in kWh/m²/year 46.65 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1006.88	792.65	812.2	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.91	0.95	0.93	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	915.36	753.23	755.14	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1314.8	1257.63	1154.83	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	287.59	375.27	297.37	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 960.24 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	71.9	93.82	74.34	0	0	0	0

Total = Sum(107)$_{6...8}$ = 240.06 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 2.95 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 49.6 (109)

Target Fabric Energy Efficiency (TFEE) 57.04 (109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)
If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)				
Number of storeys in the dwelling (ns)			0	(9)
Additional infiltration		[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction			0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35				
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0			0	(12)
If no draught lobby, enter 0.05, else enter 0			0	(13)
Percentage of windows and doors draught stripped			0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =		0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =		0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area			4	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used				
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =		0.35	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 3			6.08	x1/[1/(1.4)+ 0.04]		=	8.06			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights Type 1			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 2			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Rooflights Type 3			1.1	x1/[1/(1.3) + 0.04]		=	1.43			(27b)
Rooflights Type 4			0.78	x1/[1/(1.3) + 0.04]		=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

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can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 11.97 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 75.23 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34	

Average = Sum(39)$_{1…12}$ /12= | 112.65 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39	

Average = Sum(40)$_{1…12}$ /12= | 1.38 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	

Total = Sum(44)$_{1…12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	

Total = Sum(45)$_{1…12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) — 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	129.44	113.21	116.82	101.85	97.73	84.33	78.15	89.67	90.74	105.75	115.44	125.36	

Output from water heater (annual)$_{1...12}$ — 1248.5 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	32.36	28.3	29.21	25.46	24.43	21.08	19.54	22.42	22.69	26.44	28.86	31.34	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	43.5	42.12	39.26	35.36	32.84	29.28	26.26	30.13	31.51	35.54	40.08	42.12	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	346.24	344.96	332.98	313.22	292.32	272.8	260.51	264.29	274.78	294.68	317.6	335.6	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

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Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	584.24	782.41	1002.99	1240.81	1404.03	1404.14	1340.05	1205.09	1035.27	798.74	608.84	535.11	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.95	0.85	0.68	0.49	0.36	0.42	0.68	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.54	19.83	20.23	20.66	20.9	20.98	21	20.99	20.92	20.53	19.93	19.49	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.81	0.61	0.41	0.26	0.31	0.58	0.9	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.45	18.74	19.14	19.53	19.72	19.78	19.79	19.79	19.75	19.43	18.86	18.41	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.7	18.98	19.38	19.78	19.98	20.05	20.06	20.06	20.01	19.68	19.1	18.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

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(93)m=	18.7	18.98	19.38	19.78	19.98	20.05	20.06	20.06	20.01	19.68	19.1	18.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.81	0.62	0.43	0.29	0.34	0.6	0.9	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	579.84	763.91	931.98	1002.79	872.41	598.4	384.22	404.67	624.29	717.12	598.28	532.26	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1646.02	1606.62	1466.22	1226.08	931.44	607.21	385.38	406.97	661.21	1020.83	1354.36	1638.04	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	793.24	566.3	397.47	160.77	43.92	0	0	0	0	225.96	544.37	822.7	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3554.73 (98)

Space heating requirement in kWh/m²/year 43.62 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	1047.27	824.45	845.3	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.94	0.97	0.96	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	988.97	800.31	808.37	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	1638.2	1566.39	1424.62	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	467.45	569.97	458.49	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 1495.91 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	116.86	142.49	114.62	0	0	0	0

Total = Sum(107)$_{6...8}$ = 373.98 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 4.59 (108)

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency (99) + (108) = 48.2 (109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.35	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.45	0.44	0.43	0.39	0.38	0.33	0.33	0.33	0.35	0.38	0.4	0.41

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.6	0.59	0.58	0.57	0.56	0.56	0.55	0.56	0.57	0.58	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1.4	=	2.702			(26)
Windows Type 1			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 2			1.62		x1/[1/(1.4)+ 0.04]	=	2.15			(27)
Windows Type 3			6.08		x1/[1/(1.4)+ 0.04]	=	8.06			(27)
Windows Type 4			2.14		x1/[1/(1.4)+ 0.04]	=	2.84			(27)
Rooflights Type 1			1.33		x1/[1/(1.3) + 0.04]	=	1.729			(27b)
Rooflights Type 2			1.33		x1/[1/(1.3) + 0.04]	=	1.729			(27b)
Rooflights Type 3			1.1		x1/[1/(1.3) + 0.04]	=	1.43			(27b)
Rooflights Type 4			0.78		x1/[1/(1.3) + 0.04]	=	1.014			(27b)
Floor			40.75	x	0.17	=	6.9275			(28)
Walls Type1	102.95	16.63	86.32	x	0.2	=	17.26			(29)
Walls Type2	2	0	2	x	0.2	=	0.4			(29)
Roof	61.3	7.2	54.1	x	0.14	=	7.57			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 63.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21388.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 11.97 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 75.23 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.1	38.85	38.6	37.42	37.21	36.18	36.18	36	36.58	37.21	37.65	38.11	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	114.33	114.08	113.83	112.65	112.43	111.41	111.41	111.22	111.81	112.43	112.88	113.34	

Average = $Sum(39)_{1...12}$ /12= 112.65 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.4	1.4	1.4	1.38	1.38	1.37	1.37	1.36	1.37	1.38	1.38	1.39

Average = $Sum(40)_{1...12}$ /12= 1.38 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.49 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 93.35 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69

Total = $Sum(44)_{1...12}$ = 1120.25 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48

Total = $Sum(45)_{1...12}$ = 1468.83 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	

Output from water heater (annual)$_{1...12}$ | 1617.66 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.8	47.14	48.86	42.9	41.39	36.05	33.73	38.24	38.56	44.53	48.21	52.2	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)

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

(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)

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

(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)

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

(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)

Water heating gains (Table 5)

(72)m=	72.31	70.15	65.67	59.58	55.63	50.06	45.33	51.4	53.55	59.85	66.97	70.16	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	378.05	375.99	362.4	340.44	318.11	296.58	282.58	288.55	299.82	321.99	347.48	366.64	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	6.02	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	11.5	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	19.54	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	31.38	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	42.28	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	45.26	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	42.25	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	33.52	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	23.49	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	13.69	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	7.42	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	5.02	(74)
East	0.9x	0.77	x	2.14	x	19.64	x	0.63	x	0.8	=	14.68	(76)
East	0.9x	0.77	x	2.14	x	38.42	x	0.63	x	0.8	=	28.72	(76)
East	0.9x	0.77	x	2.14	x	63.27	x	0.63	x	0.8	=	47.29	(76)
East	0.9x	0.77	x	2.14	x	92.28	x	0.63	x	0.8	=	68.97	(76)
East	0.9x	0.77	x	2.14	x	113.09	x	0.63	x	0.8	=	84.53	(76)
East	0.9x	0.77	x	2.14	x	115.77	x	0.63	x	0.8	=	86.53	(76)
East	0.9x	0.77	x	2.14	x	110.22	x	0.63	x	0.8	=	82.38	(76)
East	0.9x	0.77	x	2.14	x	94.68	x	0.63	x	0.8	=	70.76	(76)
East	0.9x	0.77	x	2.14	x	73.59	x	0.63	x	0.8	=	55	(76)
East	0.9x	0.77	x	2.14	x	45.59	x	0.63	x	0.8	=	34.08	(76)
East	0.9x	0.77	x	2.14	x	24.49	x	0.63	x	0.8	=	18.3	(76)
East	0.9x	0.77	x	2.14	x	16.15	x	0.63	x	0.8	=	12.07	(76)
South	0.9x	0.77	x	6.08	x	46.75	x	0.63	x	0.8	=	99.28	(78)
South	0.9x	0.77	x	6.08	x	76.57	x	0.63	x	0.8	=	162.6	(78)
South	0.9x	0.77	x	6.08	x	97.53	x	0.63	x	0.8	=	207.12	(78)
South	0.9x	0.77	x	6.08	x	110.23	x	0.63	x	0.8	=	234.09	(78)
South	0.9x	0.77	x	6.08	x	114.87	x	0.63	x	0.8	=	243.94	(78)
South	0.9x	0.77	x	6.08	x	110.55	x	0.63	x	0.8	=	234.76	(78)
South	0.9x	0.77	x	6.08	x	108.01	x	0.63	x	0.8	=	229.37	(78)
South	0.9x	0.77	x	6.08	x	104.89	x	0.63	x	0.8	=	222.75	(78)
South	0.9x	0.77	x	6.08	x	101.89	x	0.63	x	0.8	=	216.36	(78)
South	0.9x	0.77	x	6.08	x	82.59	x	0.63	x	0.8	=	175.38	(78)
South	0.9x	0.77	x	6.08	x	55.42	x	0.63	x	0.8	=	117.68	(78)
South	0.9x	0.77	x	6.08	x	40.4	x	0.63	x	0.8	=	85.79	(78)

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West	0.9x	0.77	x	1.62	x	19.64	x	0.63	x	0.8	=	33.34	(80)
West	0.9x	0.77	x	1.62	x	38.42	x	0.63	x	0.8	=	65.22	(80)
West	0.9x	0.77	x	1.62	x	63.27	x	0.63	x	0.8	=	107.4	(80)
West	0.9x	0.77	x	1.62	x	92.28	x	0.63	x	0.8	=	156.64	(80)
West	0.9x	0.77	x	1.62	x	113.09	x	0.63	x	0.8	=	191.97	(80)
West	0.9x	0.77	x	1.62	x	115.77	x	0.63	x	0.8	=	196.52	(80)
West	0.9x	0.77	x	1.62	x	110.22	x	0.63	x	0.8	=	187.09	(80)
West	0.9x	0.77	x	1.62	x	94.68	x	0.63	x	0.8	=	160.71	(80)
West	0.9x	0.77	x	1.62	x	73.59	x	0.63	x	0.8	=	124.91	(80)
West	0.9x	0.77	x	1.62	x	45.59	x	0.63	x	0.8	=	77.39	(80)
West	0.9x	0.77	x	1.62	x	24.49	x	0.63	x	0.8	=	41.57	(80)
West	0.9x	0.77	x	1.62	x	16.15	x	0.63	x	0.8	=	27.42	(80)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.33	x	25.93	x	0.63	x	0.8	=	31.28	(82)
Rooflights	0.9x	1	x	1.1	x	25.93	x	0.63	x	0.8	=	12.94	(82)
Rooflights	0.9x	1	x	0.78	x	25.93	x	0.63	x	0.8	=	9.17	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.33	x	51.88	x	0.63	x	0.8	=	62.59	(82)
Rooflights	0.9x	1	x	1.1	x	51.88	x	0.63	x	0.8	=	25.88	(82)
Rooflights	0.9x	1	x	0.78	x	51.88	x	0.63	x	0.8	=	18.35	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.33	x	88.38	x	0.63	x	0.8	=	106.64	(82)
Rooflights	0.9x	1	x	1.1	x	88.38	x	0.63	x	0.8	=	44.1	(82)
Rooflights	0.9x	1	x	0.78	x	88.38	x	0.63	x	0.8	=	31.27	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.33	x	133.65	x	0.63	x	0.8	=	161.26	(82)
Rooflights	0.9x	1	x	1.1	x	133.65	x	0.63	x	0.8	=	66.69	(82)
Rooflights	0.9x	1	x	0.78	x	133.65	x	0.63	x	0.8	=	47.29	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.33	x	168.1	x	0.63	x	0.8	=	202.82	(82)
Rooflights	0.9x	1	x	1.1	x	168.1	x	0.63	x	0.8	=	83.87	(82)
Rooflights	0.9x	1	x	0.78	x	168.1	x	0.63	x	0.8	=	59.47	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.33	x	174	x	0.63	x	0.8	=	209.95	(82)
Rooflights	0.9x	1	x	1.1	x	174	x	0.63	x	0.8	=	86.82	(82)
Rooflights	0.9x	1	x	0.78	x	174	x	0.63	x	0.8	=	61.56	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.33	x	164.87	x	0.63	x	0.8	=	198.92	(82)
Rooflights	0.9x	1	x	1.1	x	164.87	x	0.63	x	0.8	=	82.26	(82)
Rooflights	0.9x	1	x	0.78	x	164.87	x	0.63	x	0.8	=	58.33	(82)
Rooflights	0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)

Rooflights 0.9x	1	x	1.33	x	138.72	x	0.63	x	0.8	=	167.38	(82)
Rooflights 0.9x	1	x	1.1	x	138.72	x	0.63	x	0.8	=	69.22	(82)
Rooflights 0.9x	1	x	0.78	x	138.72	x	0.63	x	0.8	=	49.08	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.33	x	104.33	x	0.63	x	0.8	=	125.88	(82)
Rooflights 0.9x	1	x	1.1	x	104.33	x	0.63	x	0.8	=	52.05	(82)
Rooflights 0.9x	1	x	0.78	x	104.33	x	0.63	x	0.8	=	36.91	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.33	x	62.32	x	0.63	x	0.8	=	75.2	(82)
Rooflights 0.9x	1	x	1.1	x	62.32	x	0.63	x	0.8	=	31.1	(82)
Rooflights 0.9x	1	x	0.78	x	62.32	x	0.63	x	0.8	=	22.05	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.33	x	32.54	x	0.63	x	0.8	=	39.26	(82)
Rooflights 0.9x	1	x	1.1	x	32.54	x	0.63	x	0.8	=	16.23	(82)
Rooflights 0.9x	1	x	0.78	x	32.54	x	0.63	x	0.8	=	11.51	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.33	x	21.19	x	0.63	x	0.8	=	25.57	(82)
Rooflights 0.9x	1	x	1.1	x	21.19	x	0.63	x	0.8	=	10.57	(82)
Rooflights 0.9x	1	x	0.78	x	21.19	x	0.63	x	0.8	=	7.5	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	238	437.45	670	927.58	1111.71	1131.34	1079.54	940.8	760.49	504.07	291.24	199.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	616.05	813.44	1032.4	1268.03	1429.82	1427.93	1362.12	1229.35	1060.31	826.06	638.72	566.14	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.67	0.49	0.36	0.41	0.67	0.92	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.86	20.26	20.67	20.9	20.98	21	20.99	20.93	20.55	19.96	19.52	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.76	19.76	19.77	19.78	19.78	19.79	19.79	19.79	19.78	19.78	19.77	19.77	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.93	0.8	0.6	0.4	0.26	0.31	0.57	0.89	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.9	18.31	18.88	19.43	19.7	19.78	19.79	19.79	19.74	19.3	18.48	17.83	(90)

fLA = Living area ÷ (4) = 0.22 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.27	18.66	19.19	19.71	19.97	20.05	20.06	20.06	20.01	19.58	18.81	18.21	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.12	18.51	19.04	19.56	19.82	19.9	19.91	19.91	19.86	19.43	18.66	18.06	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.92	0.79	0.6	0.41	0.27	0.32	0.58	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	609.46	788.71	946.36	1002.19	861.37	583.03	367.78	388.52	612.95	726.66	623.73	561.75	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1580.3	1552.27	1426.98	1201.04	912.73	590.27	368.65	390.24	643.49	992.87	1304.82	1570.68	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	722.3	513.11	357.58	143.17	38.21	0	0	0	0	198.06	490.38	750.64	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3213.46 (98)

Space heating requirement in kWh/m²/year 39.43 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	722.3	513.11	357.58	143.17	38.21	0	0	0	0	198.06	490.38	750.64	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	803.45	570.76	397.75	159.26	42.5	0	0	0	0	220.31	545.48	834.97	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3574.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)													
	164.93	144.61	150.08	132.06	127.61	111.45	104.58	118.14	118.99	137.06	148.04	160.12	
Efficiency of water heater												87.3	(216)
(217)m=	89.41	89.32	89.12	88.63	87.89	87.3	87.3	87.3	87.3	88.82	89.28	89.43	(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m													
(219)m=	184.47	161.91	168.41	148.99	145.2	127.66	119.79	135.32	136.3	154.31	165.81	179.04	

Total = Sum(219a)$_{1...12}$ = 1827.23 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		3574.49

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Water heating fuel used			1827.23	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			350.38	(232)
Electricity generated by PVs			-928.1	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4986.3	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	772.09	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	394.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1166.77	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.85	(268)
Energy saving/generation technologies Item 1		0.519	=	-481.68	(269)
Total CO2, kg/year		sum of (265)…(271) =		905.86	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		11.11	(273)
EI rating (section 14)				90	(274)

TER WorkSheet: New dwelling design stage

User Details:

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Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE C - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	40.75	(1a)	x	2.6	(2a)	=	105.95	(3a)
First floor	40.75	(1b)	x	2.24	(2b)	=	91.28	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	81.5	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	197.23	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.4	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.51	0.5	0.49	0.44	0.43	0.38	0.38	0.37	0.4	0.43	0.45	0.47

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.63	0.63	0.62	0.6	0.59	0.57	0.57	0.57	0.58	0.59	0.6	0.61	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			1.93	x	1	=	1.93			(26)
Windows Type 1			1.36		x1/[1/(1.4)+ 0.04]	=	1.8			(27)
Windows Type 2			1.36		x1/[1/(1.4)+ 0.04]	=	1.8			(27)
Windows Type 3			5.12		x1/[1/(1.4)+ 0.04]	=	6.79			(27)
Windows Type 4			1.8		x1/[1/(1.4)+ 0.04]	=	2.39			(27)
Rooflights Type 1			1.120176		x1/[1/(1.7) + 0.04]	=	1.904299			(27b)
Rooflights Type 2			1.120176		x1/[1/(1.7) + 0.04]	=	1.904299			(27b)
Rooflights Type 3			0.9264612		x1/[1/(1.7) + 0.04]	=	1.574984			(27b)
Rooflights Type 4			0.6569452		x1/[1/(1.7) + 0.04]	=	1.116807			(27b)
Floor			40.75	x	0.13	=	5.2975			(28)
Walls Type1	102.95	14.29	88.66	x	0.18	=	15.96			(29)
Walls Type2	2	0	2	x	0.18	=	0.36			(29)
Roof	61.3	6.06	55.24	x	0.13	=	7.18			(30)
Total area of elements, m²			207							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.77 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 21843.02 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 13.06 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 69.82 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.1	40.76	40.44	38.91	38.62	37.29	37.29	37.05	37.8	38.62	39.2	39.81	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	110.92	110.59	110.26	108.73	108.45	107.11	107.11	106.87	107.63	108.45	109.03	109.63	

Average = Sum(39)$_{1…12}$ /12= | 108.73 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.36	1.36	1.35	1.33	1.33	1.31	1.31	1.31	1.32	1.33	1.34	1.35	

Average = Sum(40)$_{1…12}$ /12= | 1.33 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.49 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 93.35 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	102.69	98.96	95.22	91.49	87.75	84.02	84.02	87.75	91.49	95.22	98.96	102.69	

Total = Sum(44)$_{1…12}$ = | 1120.25 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	152.29	133.19	137.44	119.82	114.97	99.21	91.94	105.5	106.76	124.42	135.81	147.48	

Total = Sum(45)$_{1…12}$ = | 1468.83 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.84	19.98	20.62	17.97	17.25	14.88	13.79	15.82	16.01	18.66	20.37	22.12	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	45.55	48.52	45.12	44.72	41.43	42.82	44.72	45.12	48.52	48.8	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44	

Output from water heater (annual)$_{1...12}$ | 2026.06 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	63.37	55.67	57.83	51.12	49.41	43.35	41.27	46.26	46.78	53.5	57.36	61.78	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	124.54	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.84	17.62	14.33	10.85	8.11	6.85	7.4	9.62	12.91	16.39	19.13	20.39	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	222.55	224.86	219.04	206.65	191.01	176.31	166.49	164.18	170	182.39	198.03	212.73	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	35.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	-99.63	(71)
Water heating gains (Table 5)													
(72)m=	85.18	82.85	77.73	71	66.41	60.2	55.47	62.17	64.97	71.91	79.66	83.03	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	390.93	388.68	374.46	351.86	328.89	306.72	292.72	299.33	311.24	334.05	360.18	379.51	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.36	x	10.63	x	0.63	x	0.7	=	4.42	(74)
North	0.9x	0.77	x	1.36	x	20.32	x	0.63	x	0.7	=	8.45	(74)
North	0.9x	0.77	x	1.36	x	34.53	x	0.63	x	0.7	=	14.35	(74)
North	0.9x	0.77	x	1.36	x	55.46	x	0.63	x	0.7	=	23.05	(74)
North	0.9x	0.77	x	1.36	x	74.72	x	0.63	x	0.7	=	31.05	(74)
North	0.9x	0.77	x	1.36	x	79.99	x	0.63	x	0.7	=	33.24	(74)
North	0.9x	0.77	x	1.36	x	74.68	x	0.63	x	0.7	=	31.04	(74)
North	0.9x	0.77	x	1.36	x	59.25	x	0.63	x	0.7	=	24.62	(74)
North	0.9x	0.77	x	1.36	x	41.52	x	0.63	x	0.7	=	17.26	(74)
North	0.9x	0.77	x	1.36	x	24.19	x	0.63	x	0.7	=	10.05	(74)
North	0.9x	0.77	x	1.36	x	13.12	x	0.63	x	0.7	=	5.45	(74)
North	0.9x	0.77	x	1.36	x	8.86	x	0.63	x	0.7	=	3.68	(74)
East	0.9x	0.77	x	1.8	x	19.64	x	0.63	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	1.8	x	38.42	x	0.63	x	0.7	=	21.14	(76)
East	0.9x	0.77	x	1.8	x	63.27	x	0.63	x	0.7	=	34.81	(76)
East	0.9x	0.77	x	1.8	x	92.28	x	0.63	x	0.7	=	50.76	(76)
East	0.9x	0.77	x	1.8	x	113.09	x	0.63	x	0.7	=	62.21	(76)
East	0.9x	0.77	x	1.8	x	115.77	x	0.63	x	0.7	=	63.69	(76)
East	0.9x	0.77	x	1.8	x	110.22	x	0.63	x	0.7	=	60.63	(76)
East	0.9x	0.77	x	1.8	x	94.68	x	0.63	x	0.7	=	52.08	(76)
East	0.9x	0.77	x	1.8	x	73.59	x	0.63	x	0.7	=	40.48	(76)
East	0.9x	0.77	x	1.8	x	45.59	x	0.63	x	0.7	=	25.08	(76)
East	0.9x	0.77	x	1.8	x	24.49	x	0.63	x	0.7	=	13.47	(76)
East	0.9x	0.77	x	1.8	x	16.15	x	0.63	x	0.7	=	8.88	(76)
South	0.9x	0.77	x	5.12	x	46.75	x	0.63	x	0.7	=	73.15	(78)
South	0.9x	0.77	x	5.12	x	76.57	x	0.63	x	0.7	=	119.81	(78)
South	0.9x	0.77	x	5.12	x	97.53	x	0.63	x	0.7	=	152.61	(78)
South	0.9x	0.77	x	5.12	x	110.23	x	0.63	x	0.7	=	172.49	(78)
South	0.9x	0.77	x	5.12	x	114.87	x	0.63	x	0.7	=	179.74	(78)
South	0.9x	0.77	x	5.12	x	110.55	x	0.63	x	0.7	=	172.98	(78)
South	0.9x	0.77	x	5.12	x	108.01	x	0.63	x	0.7	=	169.01	(78)
South	0.9x	0.77	x	5.12	x	104.89	x	0.63	x	0.7	=	164.13	(78)
South	0.9x	0.77	x	5.12	x	101.89	x	0.63	x	0.7	=	159.42	(78)
South	0.9x	0.77	x	5.12	x	82.59	x	0.63	x	0.7	=	129.22	(78)
South	0.9x	0.77	x	5.12	x	55.42	x	0.63	x	0.7	=	86.71	(78)
South	0.9x	0.77	x	5.12	x	40.4	x	0.63	x	0.7	=	63.21	(78)

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West	0.9x	0.77	x	1.36	x	19.64	x	0.63	x	0.7	=	24.49	(80)
West	0.9x	0.77	x	1.36	x	38.42	x	0.63	x	0.7	=	47.91	(80)
West	0.9x	0.77	x	1.36	x	63.27	x	0.63	x	0.7	=	78.9	(80)
West	0.9x	0.77	x	1.36	x	92.28	x	0.63	x	0.7	=	115.06	(80)
West	0.9x	0.77	x	1.36	x	113.09	x	0.63	x	0.7	=	141.02	(80)
West	0.9x	0.77	x	1.36	x	115.77	x	0.63	x	0.7	=	144.35	(80)
West	0.9x	0.77	x	1.36	x	110.22	x	0.63	x	0.7	=	137.43	(80)
West	0.9x	0.77	x	1.36	x	94.68	x	0.63	x	0.7	=	118.05	(80)
West	0.9x	0.77	x	1.36	x	73.59	x	0.63	x	0.7	=	91.76	(80)
West	0.9x	0.77	x	1.36	x	45.59	x	0.63	x	0.7	=	56.85	(80)
West	0.9x	0.77	x	1.36	x	24.49	x	0.63	x	0.7	=	30.54	(80)
West	0.9x	0.77	x	1.36	x	16.15	x	0.63	x	0.7	=	20.14	(80)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	1.12	x	25.93	x	0.63	x	0.7	=	23.06	(82)
Rooflights	0.9x	1	x	0.93	x	25.93	x	0.63	x	0.7	=	9.53	(82)
Rooflights	0.9x	1	x	0.66	x	25.93	x	0.63	x	0.7	=	6.76	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	1.12	x	51.88	x	0.63	x	0.7	=	46.13	(82)
Rooflights	0.9x	1	x	0.93	x	51.88	x	0.63	x	0.7	=	19.08	(82)
Rooflights	0.9x	1	x	0.66	x	51.88	x	0.63	x	0.7	=	13.53	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	1.12	x	88.38	x	0.63	x	0.7	=	78.59	(82)
Rooflights	0.9x	1	x	0.93	x	88.38	x	0.63	x	0.7	=	32.5	(82)
Rooflights	0.9x	1	x	0.66	x	88.38	x	0.63	x	0.7	=	23.04	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	1.12	x	133.65	x	0.63	x	0.7	=	118.84	(82)
Rooflights	0.9x	1	x	0.93	x	133.65	x	0.63	x	0.7	=	49.15	(82)
Rooflights	0.9x	1	x	0.66	x	133.65	x	0.63	x	0.7	=	34.85	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	1.12	x	168.1	x	0.63	x	0.7	=	149.47	(82)
Rooflights	0.9x	1	x	0.93	x	168.1	x	0.63	x	0.7	=	61.81	(82)
Rooflights	0.9x	1	x	0.66	x	168.1	x	0.63	x	0.7	=	43.83	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	1.12	x	174	x	0.63	x	0.7	=	154.72	(82)
Rooflights	0.9x	1	x	0.93	x	174	x	0.63	x	0.7	=	63.98	(82)
Rooflights	0.9x	1	x	0.66	x	174	x	0.63	x	0.7	=	45.37	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	1.12	x	164.87	x	0.63	x	0.7	=	146.6	(82)
Rooflights	0.9x	1	x	0.93	x	164.87	x	0.63	x	0.7	=	60.62	(82)
Rooflights	0.9x	1	x	0.66	x	164.87	x	0.63	x	0.7	=	42.99	(82)
Rooflights	0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)

Rooflights 0.9x	1	x	1.12	x	138.72	x	0.63	x	0.7	=	123.35	(82)
Rooflights 0.9x	1	x	0.93	x	138.72	x	0.63	x	0.7	=	51.01	(82)
Rooflights 0.9x	1	x	0.66	x	138.72	x	0.63	x	0.7	=	36.17	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	1.12	x	104.33	x	0.63	x	0.7	=	92.77	(82)
Rooflights 0.9x	1	x	0.93	x	104.33	x	0.63	x	0.7	=	38.36	(82)
Rooflights 0.9x	1	x	0.66	x	104.33	x	0.63	x	0.7	=	27.2	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	1.12	x	62.32	x	0.63	x	0.7	=	55.42	(82)
Rooflights 0.9x	1	x	0.93	x	62.32	x	0.63	x	0.7	=	22.92	(82)
Rooflights 0.9x	1	x	0.66	x	62.32	x	0.63	x	0.7	=	16.25	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	1.12	x	32.54	x	0.63	x	0.7	=	28.93	(82)
Rooflights 0.9x	1	x	0.93	x	32.54	x	0.63	x	0.7	=	11.96	(82)
Rooflights 0.9x	1	x	0.66	x	32.54	x	0.63	x	0.7	=	8.48	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	1.12	x	21.19	x	0.63	x	0.7	=	18.84	(82)
Rooflights 0.9x	1	x	0.93	x	21.19	x	0.63	x	0.7	=	7.79	(82)
Rooflights 0.9x	1	x	0.66	x	21.19	x	0.63	x	0.7	=	5.53	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	175.27	322.15	493.39	683.05	818.61	833.06	794.92	692.77	560.02	371.21	214.48	146.93	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	566.2	710.84	867.85	1034.91	1147.5	1139.79	1087.64	992.1	871.25	705.25	574.66	526.44	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.9	0.76	0.58	0.43	0.48	0.75	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.57	19.8	20.16	20.57	20.85	20.97	20.99	20.99	20.9	20.49	19.95	19.53	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.79	19.8	19.8	19.81	19.82	19.83	19.83	19.83	19.82	19.82	19.81	19.81	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.96	0.87	0.7	0.48	0.32	0.37	0.66	0.93	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.92	18.26	18.77	19.34	19.68	19.81	19.83	19.83	19.75	19.25	18.48	17.87	(90)

fLA = Living area ÷ (4) = | 0.22 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

TER WorkSheet: New dwelling design stage

(93)m=	18.29	18.6	19.08	19.62	19.95	20.07	20.09	20.09	20.01	19.53	18.81	18.25	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.86	0.7	0.5	0.34	0.39	0.67	0.92	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	561.93	697.24	823.49	892.3	807.5	571.53	371.78	390.52	585.48	649.07	565.56	523.49	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1551.47	1515.52	1386.84	1165.56	894.17	585.94	373.75	394.17	636	968.46	1276.32	1539.8	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3471.98 (98)

Space heating requirement in kWh/m²/year 42.6 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	736.22	549.89	419.13	196.75	64.49	0	0	0	0	237.63	511.75	756.14	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	788.24	588.74	448.75	210.65	69.05	0	0	0	0	254.42	547.91	809.57	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3717.33 (211)

Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)													
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0	

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)														
	203.24	178.74	185.96	164.94	159.69	140.65	134.75	150.22	151.87	172.94	184.61	198.44		
Efficiency of water heater													80.3	(216)
(217)m=	88.01	87.69	87.04	85.5	82.97	80.3	80.3	80.3	80.3	85.85	87.48	88.1		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	230.95	203.82	213.66	192.92	192.48	175.15	167.81	187.07	189.13	201.44	211.02	225.25		

Total = Sum(219a)$_{1...12}$ = 2390.71 (219)

Annual totals	kWh/year	kWh/year
Space heating fuel used, main system 1		3717.33

TER WorkSheet: New dwelling design stage

Water heating fuel used			2390.71	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			350.38	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6613.72	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	802.94	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	516.39	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1319.34	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	181.85	(268)
Total CO2, kg/year			sum of (265)…(271) =		1540.11	(272)

TER = 18.9 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE C - FINAL

Dwelling type:	Detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	West
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	520.69	**(P1)**
Transmission heat loss coefficient:	75.2	
Summer heat loss coefficient:	595.92	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
West (W1-3 FRONT)	0	1
North (W4 - SIDE N)	0	1
South (W5 - SIDE S)	0	1
East (W6 - REAR E)	0	1
West (RW1-2 FRONT W)	0	1
East (RW3-4 REAR E)	0	1
East (RW5 REAR E)	0	1
East (RW6 REAR E)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
West (W1-3 FRONT)	0.98	1	1	0.98	**(P8)**
North (W4 - SIDE N)	0.98	1	1	0.98	**(P8)**
South (W5 - SIDE S)	0.98	1	1	0.98	**(P8)**
East (W6 - REAR E)	0.98	1	1	0.98	**(P8)**
West (RW1-2 FRONT W)	0.98	1	1	0.98	**(P8)**
East (RW3-4 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW5 REAR E)	0.98	1	1	0.98	**(P8)**
East (RW6 REAR E)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**
West (W1-3 FRONT)	1 x	4.86	124.8	0.63	0.8	0.98	270.99
North (W4 - SIDE N)	1 x	1.62	86.66	0.63	0.8	0.98	62.72
South (W5 - SIDE S)	1 x	6.08	118.4	0.63	0.8	0.98	321.63
East (W6 - REAR E)	1 x	2.14	124.8	0.63	0.8	0.98	119.32
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	2.66	187.8	0.63	0.8	0.98	223.2
	1 x	1.1	187.8	0.63	0.8	0.98	92.3
	1 x	0.78	187.8	0.63	0.8	0.98	65.45

SAP 2012 Overheating Assessment

	Total	1378.81	**(P3/P4)**

Internal gains:

	June	July	August	
Internal gains	432.58	414.57	422.73	
Total summer gains	1893.39	1793.39	1640.4	**(P5)**
Summer gain/loss ratio	3.18	3.01	2.75	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	
Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	18.83	20.66	20.5	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Slight**	**Slight**	

Assessment of likelihood of high internal temperature: Slight

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:44

Project Information:

Assessed By: Jemma Mclaughlan (STRO030065) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.4m²

Site Reference : WOODWELL **Plot Reference:** HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

Client Details:

Name:

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.59 kg/m²	**OK**

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.0 kWh/m²	
		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	0.17 (max. 0.25)	0.17 (max. 0.70)	**OK**
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	**OK**
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	**OK**

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	**OK**

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	**OK**
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder		

6 Controls

Space heating controls	TTZC by plumbing and electrical services		**OK**
Hot water controls:	No cylinder thermostat		
	No cylinder		
Boiler interlock:	Yes		**OK**

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	**OK**

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	**OK**

Based on:

Overshading:	Average or unknown
Windows facing: North	3.24m²
Windows facing: West	2.59m²
Windows facing: West	0.86m²
Windows facing: South	2.14m²
Roof windows facing: South	2.66m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

Party Walls U-value	0 W/m²K
Photovoltaic array	

Thermal Bridge Report

Property Details: HOUSE D - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

SAP Input

Property Details: HOUSE D - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m

Living area:	18.35 m² (fraction 0.234)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.3	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	West	0	0
W4 - SIDE E		EXTERNAL WALLS	West	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
External Elements							
EXTERNAL WALLS	80.83	10.9	69.93	0.2	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.2	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.14	0	N/A
GROUND FLOOR	39.2			0.17		N/A
Internal Elements						
Party Elements						
PARTY WALL	29.73					N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.02 Tilt of collector: 45° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

SAP WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1...12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22

Average = Sum(40)$_{1...12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1...12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1...12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ | 1595.65 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	48.45	43.03	35	26.5	19.81	16.72	18.07	23.48	31.52	40.02	46.71	49.8	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	545.88	541.68	520.8	488.35	455.11	425.24	407.7	415.74	434.33	466.99	503.35	530.88	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
West	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(80)
West	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(80)
West	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(80)
West	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(80)
West	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(80)
West	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(80)
West	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(80)
West	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(80)
West	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(80)
West	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(80)
West	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(80)
West	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(80)

West	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(80)
West	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(80)
West	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(80)
West	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(80)
West	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(80)
West	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(80)
West	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(80)
West	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(80)
West	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(80)
West	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(80)
West	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(80)
West	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	694.35	807.23	913.32	1016.43	1079.49	1058.18	1012.58	947.7	874.11	768.77	683.59	656.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.55	0.4	0.45	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.11	20.38	20.7	20.9	20.98	21	20.99	20.94	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.46	0.31	0.35	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.77	19.16	19.58	19.83	19.91	19.92	19.92	19.88	19.56	18.96	18.44		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.82	19.08	19.45	19.84	20.08	20.16	20.17	20.17	20.13	19.82	19.25	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.93	19.3	19.69	19.93	20.01	20.02	20.02	19.98	19.67	19.1	18.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.67	0.47	0.32	0.36	0.61	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	681.18	777.68	843.63	844.46	725.3	499.3	319.77	337.28	529.06	669.23	659.06	646.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.46	1345.57	1224.39	1021.91	777.3	506.67	320.58	338.71	552.48	857	1138.76	1374.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2378.94 (98)

Space heating requirement in kWh/m²/year 30.34 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 89.9 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	579.54	424.49	315.1	142.12	43.04	0	0	0	0	155.4	384.18	602.34	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2646.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.27	89.18	88.99	88.57	87.9	87.3	87.3	87.3	87.3	88.6	89.11	89.3	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.2	159.92	166.33	147.07	143.22	125.96	118.21	133.51	134.47	152.58	163.85	176.83

Total = Sum(219a)$_{1...12}$ = 1804.16 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2646.21	
Water heating fuel used			1804.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.26	(232)
Electricity generated by PVs			-871.55	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4083.39	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	92.09	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.78	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	45.14	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-114.96	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 214.95 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.73	(257)
SAP rating (Section 12)		89.79	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	571.58	(261)

Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			961.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.63	(268)
Energy saving/generation technologies Item 1		0.519	=	-452.33	(269)
Total CO2, kg/year	sum of (265)…(271) =			725.51	(272)
CO2 emissions per m²	(272) ÷ (4) =			9.25	(273)
EI rating (section 14)				92	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3228.38	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2201.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5429.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1050.75	(268)
Energy saving/generation technologies Item 1		3.07	=	-2675.64	(269)
‘Total Primary Energy	sum of (265)…(271) =			4034.81	(272)
Primary energy kWh/m²/year	(272) ÷ (4) =			51.46	(273)

TFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1…12 | 1229.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 478.84 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 119.71 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.53 (108)

TFEE WorkSheet: New dwelling design stage

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)

Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

DFEE WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DFEE WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.48 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss — (33) + (36) = 57.1 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)1…12 /12= 94.67 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)1…12 /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	
(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	
(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43) (row 44)

Total = Sum(44)1…12 = 1103.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d) (row 45)

Total = Sum(45)1…12 = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61) (row 46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 0 (54)

Enter (50) or (54) in (55) 0 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1...12 1229.79 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.58	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.84	20.13	20.49	20.79	20.95	20.99	20.98	20.87	20.47	19.99	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.86	19.15	19.51	19.78	19.9	19.92	19.92	19.85	19.49	19.02	18.65	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.91	559.64	645.43	702.3	663.96	495.8	331.09	346.46	495.49	522.92	461.4	434.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1403.7	1360.91	1232.49	1026.55	785.58	519.2	334.35	352.26	562.54	861.83	1152.19	1398.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.2	538.46	436.77	233.46	90.48	0	0	0	0	252.16	497.37	717.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3465.06 (98)

Space heating requirement in kWh/m²/year 44.2 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	879.9	692.69	710.17	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.88	0.93	0.91	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.09	645.44	645.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	160.76	228.36	182.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 571.39 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	40.19	57.09	45.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 142.85 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.82 (108)

DFEE WorkSheet: New dwelling design stage

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.02	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15 (8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	10.48	(36)
if details of thermal bridging are not known (36) = 0.05 x (31)		
Total fabric heat loss (33) + (36) =	57.1	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16		(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26		
										Average = Sum(39)$_{1...12}$ /12=			94.67	(39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22		
										Average = Sum(40)$_{1...12}$ /12=			1.21	(40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N	2.43	(42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)		
if TFA £ 13.9, N = 1		
Annual average hot water usage in litres per day Vd,average = (25 x N) + 36	91.96	(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)														
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15		
										Total = Sum(44)$_{1...12}$ =			1103.46	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)														
(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27		
										Total = Sum(45)$_{1...12}$ =			1446.81	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)														
(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79		(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	0	(47)
If community heating and no tank in dwelling, enter 110 litres in (47)		
Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)		
Water storage loss:		
a) If manufacturer’s declared loss factor is known (kWh/day):	0	(48)
Temperature factor from Table 2b	0	(49)
Energy lost from water storage, kWh/year (48) x (49) =	0	(50)
b) If manufacturer’s declared cylinder loss factor is not known:		
Hot water storage loss factor from Table 2 (kWh/litre/day)	0	(51)
If community heating see section 4.3		
Volume factor from Table 2a	0	(52)
Temperature factor from Table 2b	0	(53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)1…12 — 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	369.58	367.49	354.15	332.66	310.86	289.85	276.2	282.14	293.19	314.89	339.81	358.48	(73)

DER WorkSheet: New dwelling design stage

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(80)

West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	496.95	595.24	690.45	784.17	843.63	829.4	792.06	736.58	669.7	573.65	494.43	466.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.51	0.57	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.87	20.16	20.52	20.8	20.95	20.99	20.98	20.88	20.49	20.02	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.58	0.39	0.44	0.74	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.16	18.43	18.85	19.36	19.73	19.89	19.92	19.92	19.83	19.34	18.65	18.12		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.52	18.77	19.16	19.63	19.98	20.14	20.17	20.17	20.07	19.61	18.97	18.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.37	18.62	19.01	19.48	19.83	19.99	20.02	20.02	19.92	19.46	18.82	18.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.4	0.45	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	494.31	587.84	668.62	715.59	664.63	486.21	317.96	334.07	493.16	541.06	488.89	464.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1352.22	1315.64	1196.57	1001.74	768.2	504.73	320.28	338.19	547.11	836.81	1112.17	1345.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3128.06 (98)

Space heating requirement in kWh/m²/year 39.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	710	544.03	436.92	229.17	85.71	0	0	0	0	244.76	499.18	729.72		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3479.49	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.36	89.3	89.17	88.87	88.27	87.3	87.3	87.3	87.3	88.89	89.25	89.38	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.01	159.7	165.99	146.57	142.62	125.96	118.21	133.51	134.47	152.09	163.6	176.67

Total = Sum(219a)$_{1...12}$ = 1801.39 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3479.49	
Water heating fuel used		1801.39	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		348.92	(232)
Electricity generated by PVs		-871.55	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		4920.55	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	751.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1140.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.09	(268)
Energy saving/generation technologies					
Item 1		0.519	=	-452.33	(269)
Total CO2, kg/year		sum of (265)…(271) =		908.35	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		11.59	(273)
EI rating (section 14)				90	(274)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE D - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	43.19	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23461.84	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)$_{1...12}$ /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)$_{1...12}$ /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	
										Total = Sum(44)$_{1...12}$ =		1103.46	(44)
Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)													
(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	
										Total = Sum(45)$_{1...12}$ =		1446.81	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)$_{1...12}$ | 1997.22 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
West	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(80)
West	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(80)
West	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(80)
West	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(80)
West	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(80)
West	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(80)
West	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(80)
West	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(80)
West	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(80)
West	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(80)
West	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(80)
West	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(80)

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West	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(80)
West	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(80)
West	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(80)
West	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(80)
West	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(80)
West	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(80)
West	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(80)
West	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(80)
West	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(80)
West	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(80)
West	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(80)
West	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(80)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)
										fLA = Living area ÷ (4) =			0.23	(91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	3173.97	(98)
Space heating requirement in kWh/m²/year	40.48	(99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3398.26	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Output from water heater (calculated above)														
	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23		
Efficiency of water heater													80.3	(216)

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4

Total = $Sum(219a)_{1...12}$ = 2356.83 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3398.26	
Water heating fuel used		2356.83	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =		6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE D - FINAL

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	57.1	
Summer heat loss coefficient:	591.1	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
West (W3 - SIDE E)	0	1
West (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
West (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
West (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
West (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
West (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	422.24	404.7	412.74	
Total summer gains	1133.38	1076.17	1007.8	**(P5)**
Summer gain/loss ratio	1.92	1.82	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.57	19.47	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.25
Printed on 25 February 2021 at 14:04:40

Project Information:

Assessed By: Jemma Mclaughlan (STRO030065) **Building Type:** Semi-detached House

Dwelling Details:

NEW DWELLING DESIGN STAGE Total Floor Area: 78.4m²

Site Reference : WOODWELL **Plot Reference:** HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

Client Details:

Name:

Address :

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 system: Mains gas
Fuel factor: 1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER)	18.72 kg/m²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.66 kg/m²	OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	53.0 kWh/m²	
Dwelling Fabric Energy Efficiency (DFEE)	46.0 kWh/m²	
		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	0.17 (max. 0.25)	0.17 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main Heating system:	Database: (rev 472, product index 017179): Boiler systems with radiators or underfloor heating - mains gas Brand name: Ideal Model: LOGIC CODE COMBI Model qualifier: ES33 (Combi) Efficiency 89.0 % SEDBUK2009 Minimum 88.0 %	OK
Secondary heating system:	None	

Regulations Compliance Report

5 Cylinder insulation

Hot water Storage:	No cylinder	

6 Controls

Space heating controls	TTZC by plumbing and electrical services	OK
Hot water controls:	No cylinder thermostat No cylinder	
Boiler interlock:	Yes	OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (South East England):	Not significant	OK

Based on:

Overshading:	Average or unknown
Windows facing: North	3.24m²
Windows facing: East	2.59m²
Windows facing: East	0.86m²
Windows facing: South	2.14m²
Roof windows facing: South	2.66m²
Ventilation rate:	8.00
Blinds/curtains:	Dark-coloured curtain or roller blind Closed 10% of daylight hours

10 Key features

Party Walls U-value	0 W/m²K
Photovoltaic array	

Thermal Bridge Report

Property Details: HOUSE E - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England

Thermal bridges:

Thermal bridges:

User-defined = UD
Default = D
Approved = A
User-defined (individual PSI-values) Y-Value = 0.0583

External Junctions Details:

Junction Type	PSI-Value	Length	Reference	Type
Other lintels (including other steel lintels)	0.05	6.44	E2	[UD]
Sill	0.04	2.7	E3	[A]
Jamb	0.05	20.7	E4	[A]
Ground floor (normal)	0.08	18.11	E5	[UD]
Intermediate floor within a dwelling	0.07	18.11	E6	[A]
Eaves (insulation at rafter level)	0.04	12.43	E11	[A]
Gable (insulation at rafter level)	0.04	18.49	E13	[A]
Corner (normal)	0.09	12.6	E16	[A]
Staggered party wall between dwellings	0.12	6.4	E25	[D]

Party Junctions Details:

Ground floor	0.16	6.15	P1	[D]
Roof (insulation at rafter level)	0.08	8.98	P5	[D]

Roof Junctions Details:

Head	0.08	2.95	R1	[D]
Sill	0.06	2.95	R2	[D]
Jamb	0.08	5.4	R3	[D]
Ridge (vaulted ceiling)	0.08	7.6	R4	[D]

SAP Input

Property Details: HOUSE E - FINAL

Address:	Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU
Located in:	England
Region:	South East England
UPRN:	0125535868
Date of assessment:	24 February 2021
Date of certificate:	25 February 2021
Assessment type:	New dwelling design stage
Transaction type:	Marketed sale
Tenure type:	Unknown
Related party disclosure:	No related party
Thermal Mass Parameter:	Indicative Value Medium
Water use <= 125 litres/person/day:	True
PCDF Version:	472

Property description:

Dwelling type:	House
Detachment:	Semi-detached
Year Completed:	2021

Floor Location:	Floor area:	Storey height:
Floor 0	39.2 m²	2.6 m
Floor 1	39.2 m²	2.56 m

Living area:	18.35 m² (fraction 0.234)
Front of dwelling faces:	North

Opening types:

Name:	Source:	Type:	Glazing:	Argon:	Frame:
FRONT DOOR	Manufacturer	Solid			Wood
W1-2 FRONT N	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W3 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W4 - SIDE E	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
W5 - REAR S	Manufacturer	Windows	low-E, En = 0.05, soft coat	Yes	Wood
RW1-2 REAR S	Manufacturer	Roof Windows	low-E, En = 0.05, soft coat	Yes	Metal

Name:	**Gap:**	**Frame Factor:**	**g-value:**	**U-value:**	**Area:**	**No. of Openings:**
FRONT DOOR	mm	0.8	0	1.4	2.07	1
W1-2 FRONT N	16mm or more	0.8	0.63	1.4	1.62	2
W3 - SIDE E	16mm or more	0.8	0.63	1.4	2.59	1
W4 - SIDE E	16mm or more	0.8	0.63	1.4	0.86	1
W5 - REAR S	16mm or more	0.8	0.63	1.4	2.14	1
RW1-2 REAR S	16mm or more	0.8	0.63	1.3	1.33	2

Name:	Type-Name:	Location:	Orient:	Width:	Height:
FRONT DOOR		EXTERNAL WALLS	North	0	0
W1-2 FRONT N		EXTERNAL WALLS	North	0	0
W3 - SIDE E		EXTERNAL WALLS	East	0	0
W4 - SIDE E		EXTERNAL WALLS	East	0	0
W5 - REAR S		EXTERNAL WALLS	South	0	0
RW1-2 REAR S		ROOF	South	0.001	0

Overshading: Average or unknown

Opaque Elements:

Type:	Gross area:	Openings:	Net area:	U-value:	Ru value:	Curtain wall:	Kappa:
<u>External Elements</u>							
EXTERNAL WALLS	80.83	10.9	69.93	0.2	0	False	N/A
DORMER CHEEKS	2.12	0	2.12	0.2	0	False	N/A

SAP Input

ROOF	57.4	2.66	54.74	0.14	0	N/A
GROUND FLOOR	39.2			0.17		N/A

Internal Elements

Party Elements

PARTY WALL	29.73	N/A

Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0583

	Length	Psi-value		
	6.44	0.05	E2	Other lintels (including other steel lintels)
[Approved]	2.7	0.04	E3	Sill
[Approved]	20.7	0.05	E4	Jamb
	18.11	0.08	E5	Ground floor (normal)
[Approved]	18.11	0.07	E6	Intermediate floor within a dwelling
[Approved]	12.43	0.04	E11	Eaves (insulation at rafter level)
[Approved]	18.49	0.04	E13	Gable (insulation at rafter level)
[Approved]	12.6	0.09	E16	Corner (normal)
	6.4	0.12	E25	Staggered party wall between dwellings
	6.15	0.16	P1	Ground floor
	8.98	0.08	P5	Roof (insulation at rafter level)
	2.95	0.08	R1	Head
	2.95	0.06	R2	Sill
	5.4	0.08	R3	Jamb
	7.6	0.08	R4	Ridge (vaulted ceiling)

Ventilation:

Pressure test:	Yes (As designed)
Ventilation:	Natural ventilation (extract fans)
Number of chimneys:	0
Number of open flues:	0
Number of fans:	3
Number of passive stacks:	0
Number of sides sheltered:	1
Pressure test:	4

Main heating system:

Main heating system:

Boiler systems with radiators or underfloor heating
Gas boilers and oil boilers
Fuel: mains gas
Info Source: Boiler Database
Database: (rev 472, product index 017179) Efficiency: Winter 87.3 % Summer: 89.9
Has integral PFGHRD
Brand name: Ideal
Model: LOGIC CODE COMBI
Model qualifier: ES33
(Combi boiler)
Systems with radiators
Central heating pump : 2013 or later
Design flow temperature: Design flow temperature >45°C
Open
Boiler interlock: Yes
Delayed start

Main heating Control:

Main heating Control:

Time and temperature zone control by suitable arrangement of plumbing and electrical services
Control code: 2110

Secondary heating system:

Secondary heating system: None

SAP Input

Water heating:	
Water heating:	From main heating system Water code: 901 Fuel :mains gas No hot water cylinder Flue Gas Heat Recovery System: Database (rev 472, product index) Solar panel: False

Others:	
Electricity tariff:	Standard Tariff
In Smoke Control Area:	Yes
Conservatory:	No conservatory
Low energy lights:	100%
Terrain type:	Low rise urban / suburban
EPC language:	English
Wind turbine:	No
Photovoltaics:	Photovoltaic 1 Installed Peak power: 1.36 Tilt of collector: 45° Overshading: None or very little Collector Orientation: South
Assess Zero Carbon Home:	No

SAP WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)$_{1…12}$ /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22

Average = Sum(40)$_{1…12}$ /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)$_{1…12}$ = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)$_{1…12}$ = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ | 1595.65 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	145.91	(66)

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

(67)m=	48.45	43.03	35	26.5	19.81	16.72	18.07	23.48	31.52	40.02	46.71	49.8	(67)

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

(68)m=	322.48	325.83	317.4	299.44	276.78	255.48	241.26	237.91	246.34	264.29	286.96	308.25	(68)

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

(69)m=	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	52.02	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	545.88	541.68	520.8	488.35	455.11	425.24	407.7	415.74	434.33	466.99	503.35	530.88	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	1	x	1.62	x	10.63	x	0.63	x	0.8	=	15.63	(74)
North	0.9x	1	x	1.62	x	20.32	x	0.63	x	0.8	=	29.86	(74)
North	0.9x	1	x	1.62	x	34.53	x	0.63	x	0.8	=	50.75	(74)
North	0.9x	1	x	1.62	x	55.46	x	0.63	x	0.8	=	81.51	(74)
North	0.9x	1	x	1.62	x	74.72	x	0.63	x	0.8	=	109.81	(74)
North	0.9x	1	x	1.62	x	79.99	x	0.63	x	0.8	=	117.55	(74)
North	0.9x	1	x	1.62	x	74.68	x	0.63	x	0.8	=	109.75	(74)
North	0.9x	1	x	1.62	x	59.25	x	0.63	x	0.8	=	87.07	(74)
North	0.9x	1	x	1.62	x	41.52	x	0.63	x	0.8	=	61.02	(74)
North	0.9x	1	x	1.62	x	24.19	x	0.63	x	0.8	=	35.55	(74)
North	0.9x	1	x	1.62	x	13.12	x	0.63	x	0.8	=	19.28	(74)
North	0.9x	1	x	1.62	x	8.86	x	0.63	x	0.8	=	13.03	(74)
East	0.9x	1	x	2.59	x	19.64	x	0.63	x	0.8	=	23.07	(76)
East	0.9x	1	x	0.86	x	19.64	x	0.63	x	0.8	=	7.66	(76)
East	0.9x	1	x	2.59	x	38.42	x	0.63	x	0.8	=	45.14	(76)
East	0.9x	1	x	0.86	x	38.42	x	0.63	x	0.8	=	14.99	(76)
East	0.9x	1	x	2.59	x	63.27	x	0.63	x	0.8	=	74.33	(76)
East	0.9x	1	x	0.86	x	63.27	x	0.63	x	0.8	=	24.68	(76)
East	0.9x	1	x	2.59	x	92.28	x	0.63	x	0.8	=	108.41	(76)
East	0.9x	1	x	0.86	x	92.28	x	0.63	x	0.8	=	36	(76)
East	0.9x	1	x	2.59	x	113.09	x	0.63	x	0.8	=	132.86	(76)
East	0.9x	1	x	0.86	x	113.09	x	0.63	x	0.8	=	44.12	(76)
East	0.9x	1	x	2.59	x	115.77	x	0.63	x	0.8	=	136.01	(76)
East	0.9x	1	x	0.86	x	115.77	x	0.63	x	0.8	=	45.16	(76)
East	0.9x	1	x	2.59	x	110.22	x	0.63	x	0.8	=	129.49	(76)
East	0.9x	1	x	0.86	x	110.22	x	0.63	x	0.8	=	43	(76)
East	0.9x	1	x	2.59	x	94.68	x	0.63	x	0.8	=	111.23	(76)
East	0.9x	1	x	0.86	x	94.68	x	0.63	x	0.8	=	36.93	(76)
East	0.9x	1	x	2.59	x	73.59	x	0.63	x	0.8	=	86.45	(76)
East	0.9x	1	x	0.86	x	73.59	x	0.63	x	0.8	=	28.71	(76)
East	0.9x	1	x	2.59	x	45.59	x	0.63	x	0.8	=	53.56	(76)
East	0.9x	1	x	0.86	x	45.59	x	0.63	x	0.8	=	17.78	(76)
East	0.9x	1	x	2.59	x	24.49	x	0.63	x	0.8	=	28.77	(76)
East	0.9x	1	x	0.86	x	24.49	x	0.63	x	0.8	=	9.55	(76)
East	0.9x	1	x	2.59	x	16.15	x	0.63	x	0.8	=	18.97	(76)
East	0.9x	1	x	0.86	x	16.15	x	0.63	x	0.8	=	6.3	(76)

South	0.9x	1	x	2.14	x	46.75	x	0.63	x	0.8	=	45.38	(78)
South	0.9x	1	x	2.14	x	76.57	x	0.63	x	0.8	=	74.32	(78)
South	0.9x	1	x	2.14	x	97.53	x	0.63	x	0.8	=	94.68	(78)
South	0.9x	1	x	2.14	x	110.23	x	0.63	x	0.8	=	107.01	(78)
South	0.9x	1	x	2.14	x	114.87	x	0.63	x	0.8	=	111.51	(78)
South	0.9x	1	x	2.14	x	110.55	x	0.63	x	0.8	=	107.31	(78)
South	0.9x	1	x	2.14	x	108.01	x	0.63	x	0.8	=	104.85	(78)
South	0.9x	1	x	2.14	x	104.89	x	0.63	x	0.8	=	101.82	(78)
South	0.9x	1	x	2.14	x	101.89	x	0.63	x	0.8	=	98.9	(78)
South	0.9x	1	x	2.14	x	82.59	x	0.63	x	0.8	=	80.17	(78)
South	0.9x	1	x	2.14	x	55.42	x	0.63	x	0.8	=	53.79	(78)
South	0.9x	1	x	2.14	x	40.4	x	0.63	x	0.8	=	39.21	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	148.47	265.54	392.52	528.08	624.38	632.94	604.88	531.96	439.78	301.78	180.24	125.44	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	694.35	807.23	913.32	1016.43	1079.49	1058.18	1012.58	947.7	874.11	768.77	683.59	656.32	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.87	0.73	0.55	0.4	0.45	0.69	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.92	20.11	20.38	20.7	20.9	20.98	21	20.99	20.94	20.67	20.23	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.93	0.84	0.67	0.46	0.31	0.35	0.6	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.49	18.77	19.16	19.58	19.83	19.91	19.92	19.92	19.88	19.56	18.96	18.44	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.82	19.08	19.45	19.84	20.08	20.16	20.17	20.17	20.13	19.82	19.25	18.78	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.67	18.93	19.3	19.69	19.93	20.01	20.02	20.02	19.98	19.67	19.1	18.63	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.96	0.92	0.83	0.67	0.47	0.32	0.36	0.61	0.87	0.96	0.98	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	681.18	777.68	843.63	844.46	725.3	499.3	319.77	337.28	529.06	669.23	659.06	646.38	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.46	1345.57	1224.39	1021.91	777.3	506.67	320.58	338.71	552.48	857	1138.76	1374.21	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2378.94 (98)

Space heating requirement in kWh/m²/year 30.34 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	521.01	381.62	283.28	127.76	38.69	0	0	0	0	139.7	345.38	541.5	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	579.54	424.49	315.1	142.12	43.04	0	0	0	0	155.4	384.18	602.34	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2646.21 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

(217)m=	89.27	89.18	88.99	88.57	87.9	87.3	87.3	87.3	87.3	88.6	89.11	89.3	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.2	159.92	166.33	147.07	143.22	125.96	118.21	133.51	134.47	152.58	163.85	176.83

Total = Sum(219a)$_{1...12}$ = 1804.16 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2646.21	
Water heating fuel used			1804.16	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			342.26	(232)
Electricity generated by PVs			-1162.06	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			3792.88	(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	**Fuel Price** (Table 12)		**Fuel Cost** £/year	
Space heating - main system 1	(211) x	3.48	x 0.01 =	92.09	(240)
Space heating - main system 2	(213) x	0	x 0.01 =	0	(241)
Space heating - secondary	(215) x	13.19	x 0.01 =	0	(242)
Water heating cost (other fuel)	(219)	3.48	x 0.01 =	62.78	(247)
Pumps, fans and electric keep-hot	(231)	13.19	x 0.01 =	9.89	(249)

(if off-peak tariff, list each of (230a) to (230g) separately as applicable and apply fuel price according to Table 12a

Energy for lighting	(232)	13.19	x 0.01 =	45.14	(250)
Additional standing charges (Table 12)				120	(251)
	one of (233) to (235) x)	13.19	x 0.01 =	-153.28	(252)

Appendix Q items: repeat lines (253) and (254) as needed

Total energy cost (245)...(247) + (250)…(254) = 176.63 (255)

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	[(255) x (256)] ÷ [(4) + 45.0] =	0.6	(257)
SAP rating (Section 12)		91.61	(258)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	571.58	(261)

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Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.7	(264)
Space and water heating	(261) + (262) + (263) + (264) =			961.28	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	177.63	(268)
Energy saving/generation technologies Item 1		0.519	=	-603.11	(269)
Total CO2, kg/year		sum of (265)…(271) =		574.73	(272)
CO2 emissions per m²		(272) ÷ (4) =		7.33	(273)
EI rating (section 14)				94	(274)

13a. Primary Energy

	Energy kWh/year	**Primary** factor		**P. Energy** kWh/year	
Space heating (main system 1)	(211) x	1.22	=	3228.38	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	1.22	=	2201.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			5429.46	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	230.25	(267)
Electricity for lighting	(232) x	0	=	1050.75	(268)
Energy saving/generation technologies Item 1		3.07	=	-3567.53	(269)
'Total Primary Energy		sum of (265)…(271) =		3142.93	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		40.09	(273)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total			m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40	=	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20	=	0	(6b)
Number of intermittent fans							3	x 10	=	30	(7a)
Number of passive vents							0	x 10	=	0	(7b)
Number of flueless gas fires							0	x 40	=	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 43.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19	

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)1…12 | 1229.79 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	338.65	337.27	325.44	306.02	285.55	266.49	254.54	258.38	268.75	288.3	310.76	328.33	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

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South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	450.1	536.55	619.7	701.09	751.73	738.6	705.91	656.01	598.19	514.71	446.05	422.49	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.88	0.72	0.55	0.61	0.85	0.98	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.66	19.83	20.11	20.47	20.77	20.94	20.99	20.98	20.86	20.46	19.99	19.64	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.84	0.63	0.43	0.49	0.78	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

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(90)m=	18.7	18.87	19.15	19.51	19.78	19.92	19.95	19.95	19.86	19.5	19.04	18.68	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.92	19.1	19.37	19.73	20.01	20.16	20.19	20.19	20.1	19.73	19.26	18.91	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.94	0.84	0.65	0.46	0.52	0.8	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	448.76	532.72	607.76	659.91	631.38	479.8	323.54	337.91	475.61	496.09	443.22	421.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1381.67	1337.36	1209.01	1002.99	767.52	507.12	327.41	344.65	549.56	842.77	1129.49	1373.09	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	694.08	540.72	447.32	247.02	101.29	0	0	0	0	257.93	494.11	707.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3490.42 (98)

Space heating requirement in kWh/m²/year 44.52 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	857.31	674.9	691.53	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.86	0.92	0.9	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	738.17	622.55	621.41	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	920.76	882.07	828.78	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	131.47	193.09	154.28	0	0	0	0	

Total = Sum(104)$_{6..8}$ = 478.84 (104)

Cooled fraction — f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6..8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	32.87	48.27	38.57	0	0	0	0

Total = Sum(107)$_{6..8}$ = 119.71 (107)

Space cooling requirement in kWh/m²/year — (107) ÷ (4) = 1.53 (108)

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8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.05	(109)
Target Fabric Energy Efficiency (TFEE)		52.95	(109)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K — 10.48 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 57.1 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26	

Average = Sum(39)1…12 /12= 94.67 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22	

Average = Sum(40)1…12 /12= 1.21 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.43 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 91.96 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15	

Total = Sum(44)1…12 = 1103.46 (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27	

Total = Sum(45)1…12 = 1446.81 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	0	0	0	0	0	0	0	0	0	0	0	0	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0 (51)

If community heating see section 4.3

Volume factor from Table 2a — 0 (52)

Temperature factor from Table 2b — 0 (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 — (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	0	0	0	0	0	0	0	0	0	0	0	0	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	127.5	111.52	115.07	100.32	96.26	83.07	76.97	88.33	89.38	104.17	113.71	123.48	

Output from water heater (annual)$_{1...12}$ — 1229.79 — (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	31.88	27.88	28.77	25.08	24.07	20.77	19.24	22.08	22.35	26.04	28.43	30.87	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	42.84	41.49	38.67	34.83	32.35	28.84	25.87	29.68	31.04	35	39.48	41.49	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	338.14	336.82	325.07	305.74	285.34	266.31	254.35	258.13	268.42	287.88	310.27	327.81	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	465.51	564.57	661.37	757.25	818.12	805.87	770.21	712.57	644.93	546.63	464.89	435.42	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.86	0.69	0.52	0.58	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.65	19.84	20.13	20.49	20.79	20.95	20.99	20.98	20.87	20.47	19.99	19.62	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.81	0.59	0.4	0.46	0.75	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.86	19.15	19.51	19.78	19.9	19.92	19.92	19.85	19.49	19.02	18.65	(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.9	19.09	19.38	19.74	20.01	20.15	20.17	20.17	20.09	19.72	19.25	18.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.98	0.93	0.81	0.62	0.43	0.49	0.77	0.96	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	463.91	559.64	645.43	702.3	663.96	495.8	331.09	346.46	495.49	522.92	461.4	434.32	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1403.7	1360.91	1232.49	1026.55	785.58	519.2	334.35	352.26	562.54	861.83	1152.19	1398.25	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	699.2	538.46	436.77	233.46	90.48	0	0	0	0	252.16	497.37	717.16	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3465.06 (98)

Space heating requirement in kWh/m²/year 44.2 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)													
(100)m=	0	0	0	0	0	879.9	692.69	710.17	0	0	0	0	(100)
Utilisation factor for loss hm													
(101)m=	0	0	0	0	0	0.88	0.93	0.91	0	0	0	0	(101)
Useful loss, hmLm (Watts) = (100)m x (101)m													
(102)m=	0	0	0	0	0	771.09	645.44	645.45	0	0	0	0	(102)
Gains (solar gains calculated for applicable weather region, see Table 10)													
(103)m=	0	0	0	0	0	994.37	952.37	890.45	0	0	0	0	(103)
Space cooling requirement for month, whole dwelling, continuous (kWh) = 0.024 x [(103)m – (102)m] x (41)m set (104)m to zero if (104)m < 3 × (98)m													
(104)m=	0	0	0	0	0	160.76	228.36	182.28	0	0	0	0	

Total = Sum(104)$_{6...8}$ = 571.39 (104)

Cooled fraction f C = cooled area ÷ (4) = 1 (105)

Intermittency factor (Table 10b)

(106)m=	0	0	0	0	0	0.25	0.25	0.25	0	0	0	0

Total = Sum(104)$_{6...8}$ = 0 (106)

Space cooling requirement for month = (104)m × (105) × (106)m

(107)m=	0	0	0	0	0	40.19	57.09	45.57	0	0	0	0

Total = Sum(107)$_{6...8}$ = 142.85 (107)

Space cooling requirement in kWh/m²/year (107) ÷ (4) = 1.82 (108)

DFEE WorkSheet: New dwelling design stage

8f. Fabric Energy Efficiency (calculated only under special conditions, see section 11)			
Fabric Energy Efficiency	(99) + (108) =	46.02	(109)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)

if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35

If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		4	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.35	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.32	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

DER WorkSheet: New dwelling design stage

Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.41	0.4	0.39	0.35	0.35	0.31	0.31	0.3	0.32	0.35	0.36	0.38

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.58	0.56	0.56	0.55	0.55	0.54	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1.4	=	2.898			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.3) + 0.04]		=	1.729			(27b)
Floor			39.2	x	0.17	=	6.664			(28)
Walls Type1	80.83	10.9	69.93	x	0.2	=	13.99			(29)
Walls Type2	2.12	0	2.12	x	0.2	=	0.42			(29)
Roof	57.4	2.66	54.74	x	0.14	=	7.66			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 46.63 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 23461.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.48 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 57.1 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	39.01	38.79	38.57	37.57	37.38	36.5	36.5	36.34	36.84	37.38	37.76	38.16	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	96.11	95.89	95.68	94.67	94.48	93.61	93.61	93.44	93.94	94.48	94.86	95.26

Average = Sum(39)1…12 /12= | 94.67 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.23	1.22	1.22	1.21	1.21	1.19	1.19	1.19	1.2	1.21	1.21	1.22

Average = Sum(40)1…12 /12= | 1.21 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

DER WorkSheet: New dwelling design stage

Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	12.64	11.42	12.64	12.23	12.64	12.23	12.64	12.64	12.23	12.64	12.23	12.64	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91	

Output from water heater (annual)$_{1...12}$ — 1595.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	53.04	46.48	48.17	42.3	40.82	35.55	33.27	37.71	38.02	43.91	47.54	51.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	19.76	17.55	14.27	10.8	8.08	6.82	7.37	9.58	12.85	16.32	19.05	20.31	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)
Water heating gains (Table 5)													
(72)m=	71.29	69.16	64.75	58.75	54.86	49.38	44.72	50.69	52.81	59.02	66.03	69.17	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	369.58	367.49	354.15	332.66	310.86	289.85	276.2	282.14	293.19	314.89	339.81	358.48	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.8	=	12.03	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.8	=	23	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.8	=	39.08	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.8	=	62.77	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.8	=	84.55	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.8	=	90.51	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.8	=	84.51	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.8	=	67.05	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.8	=	46.98	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.8	=	27.37	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.8	=	14.84	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.8	=	10.03	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.8	=	17.77	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.8	=	5.9	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.8	=	34.76	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.8	=	11.54	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.8	=	57.24	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.8	=	19.01	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.8	=	83.48	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.8	=	27.72	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.8	=	102.31	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.8	=	33.97	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.8	=	104.73	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.8	=	34.77	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.8	=	99.71	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.8	=	33.11	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.8	=	85.65	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.8	=	28.44	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.8	=	66.57	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.8	=	22.1	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.8	=	41.24	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.8	=	13.69	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.8	=	22.15	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.8	=	7.36	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.8	=	14.61	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.8	=	4.85	(76)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.8	=	34.94	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.8	=	57.23	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.8	=	72.9	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.8	=	82.39	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.8	=	85.86	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.8	=	82.63	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.8	=	80.73	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.8	=	78.4	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.8	=	76.15	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.8	=	61.73	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.8	=	41.42	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.8	=	30.2	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.8	=	56.72	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.8	=	101.23	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.8	=	148.08	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.8	=	195.15	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.8	=	226.09	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.8	=	226.91	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.8	=	217.8	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.8	=	194.91	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.8	=	164.7	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.8	=	114.72	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.8	=	68.85	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.8	=	47.92	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	127.37	227.75	336.3	451.51	532.77	539.55	515.86	454.44	376.51	258.76	154.62	107.61	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	496.95	595.24	690.45	784.17	843.63	829.4	792.06	736.58	669.7	573.65	494.43	466.1	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.85	0.67	0.51	0.57	0.82	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.69	19.87	20.16	20.52	20.8	20.95	20.99	20.98	20.88	20.49	20.02	19.66	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.9	19.9	19.9	19.91	19.92	19.92	19.92	19.93	19.92	19.92	19.91	19.91	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.92	0.79	0.58	0.39	0.44	0.74	0.95	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

DER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.16	18.43	18.85	19.36	19.73	19.89	19.92	19.92	19.83	19.34	18.65	18.12		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.52	18.77	19.16	19.63	19.98	20.14	20.17	20.17	20.07	19.61	18.97	18.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.37	18.62	19.01	19.48	19.83	19.99	20.02	20.02	19.92	19.46	18.82	18.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.79	0.59	0.4	0.45	0.74	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	494.31	587.84	668.62	715.59	664.63	486.21	317.96	334.07	493.16	541.06	488.89	464.24	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1352.22	1315.64	1196.57	1001.74	768.2	504.73	320.28	338.19	547.11	836.81	1112.17	1345.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3128.06 (98)

Space heating requirement in kWh/m²/year 39.9 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		89.9	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	638.29	489.08	392.79	206.03	77.05	0	0	0	0	220.04	448.76	656.02	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	710	544.03	436.92	229.17	85.71	0	0	0	0	244.76	499.18	729.72	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3479.49 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

162.64	142.61	148.02	130.26	125.89	109.96	103.2	116.56	117.39	135.19	146.01	157.91

Efficiency of water heater 87.3 (216)

DER WorkSheet: New dwelling design stage

(217)m=	89.36	89.3	89.17	88.87	88.27	87.3	87.3	87.3	87.3	88.89	89.25	89.38	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	182.01	159.7	165.99	146.57	142.62	125.96	118.21	133.51	134.47	152.09	163.6	176.67	

Total = Sum(219a)$_{1...12}$ = 1801.39 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3479.49	
Water heating fuel used			1801.39	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			348.92	(232)
Electricity generated by PVs			-1162.06	(233)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			4630.04	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	751.57	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	389.1	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1140.67	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	181.09	(268)
Energy saving/generation technologies Item 1		0.519	=	-603.11	(269)
Total CO2, kg/year		sum of (265)…(271) =		757.57	(272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =		9.66	(273)
EI rating (section 14)				92	(274)

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User Details:

Assessor Name:	Jemma Mclaughlan	**Stroma Number:**	STRO030065
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.5.25

Property Address: HOUSE E - FINAL

Address : Woodwell Cottage P2, Woodwell Road, BRISTOL, BS11 9XU

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.6	(2a)	=	101.92	(3a)
First floor	39.2	(1b)	x	2.56	(2b)	=	100.35	(3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	78.4	(4)						
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)		=	202.27	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

Air changes per hour

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.92	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

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Wind Factor (22a)m = (22)m ÷ 4

(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.41	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.07	x	1	=	2.07			(26)
Windows Type 1			1.62	x1/[1/(1.4)+ 0.04]		=	2.15			(27)
Windows Type 2			2.59	x1/[1/(1.4)+ 0.04]		=	3.43			(27)
Windows Type 3			0.86	x1/[1/(1.4)+ 0.04]		=	1.14			(27)
Windows Type 4			2.14	x1/[1/(1.4)+ 0.04]		=	2.84			(27)
Rooflights			1.33	x1/[1/(1.7) + 0.04]		=	2.261			(27b)
Floor			39.2	x	0.13	=	5.096			(28)
Walls Type1	80.83	10.9	69.93	x	0.18	=	12.59			(29)
Walls Type2	2.12	0	2.12	x	0.18	=	0.38			(29)
Roof	57.4	2.66	54.74	x	0.13	=	7.12			(30)
Total area of elements, m²			179.55							(31)
Party wall			29.73	x	0	=	0			(32)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	43.19	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	23461.84	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f

can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 10.55 | (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = | 53.74 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.74	40.45	40.17	38.86	38.61	37.46	37.46	37.25	37.91	38.61	39.11	39.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.48	94.19	93.91	92.6	92.35	91.2	91.2	90.99	91.64	92.35	92.85	93.37	

Average = Sum(39)1…12 /12= | 92.59 | (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.21	1.2	1.2	1.18	1.18	1.16	1.16	1.16	1.17	1.18	1.18	1.19

Average = Sum(40)1…12 /12= | 1.18 | (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N | 2.43 | (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 | 91.96 | (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	101.15	97.47	93.79	90.12	86.44	82.76	82.76	86.44	90.12	93.79	97.47	101.15

Total = Sum(44)1…12 = | 1103.46 | (44)

Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)

(45)m=	150	131.19	135.38	118.03	113.25	97.73	90.56	103.92	105.16	122.55	133.77	145.27

Total = Sum(45)1…12 = | 1446.81 | (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.5	19.68	20.31	17.7	16.99	14.66	13.58	15.59	15.77	18.38	20.07	21.79	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel | 0 | (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): | 0 | (48)

Temperature factor from Table 2b | 0 | (49)

Energy lost from water storage, kWh/year (48) x (49) = | 0 | (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) | 0 | (51)

If community heating see section 4.3

Volume factor from Table 2a | 0 | (52)

Temperature factor from Table 2b | 0 | (53)

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Energy lost from water storage, kWh/year	(47) x (51) x (52) x (53) =	0	(54)
Enter (50) or (54) in (55)		0	(55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	0	0	0	0	0	0	0	0	0	0	0	0	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	0	0	0	0	0	0	0	0	0	0	0	0	(57)

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

(59)m=	0	0	0	0	0	0	0	0	0	0	0	0	(59)

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

(61)m=	50.96	44.86	47.8	44.44	44.05	40.81	42.17	44.05	44.44	47.8	48.07	50.96	(61)

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

(62)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)
FHRS	0	0	0	0	0	0	0	0	0	0	0	0	(63) (G2)

Output from water heater

(64)m=	200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23	

Output from water heater (annual)$_{1...12}$ | 1997.22 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	62.62	54.84	56.96	50.35	48.67	42.7	40.65	45.56	46.08	52.7	56.5	61.04	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

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=	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	121.59	(66)

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

(67)m=	20.26	18	14.64	11.08	8.28	6.99	7.56	9.82	13.18	16.74	19.54	20.83	(67)

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

(68)m=	216.06	218.31	212.66	200.63	185.44	171.17	161.64	159.4	165.05	177.08	192.26	206.53	(68)

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

(69)m=	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	35.16	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	-97.27	(71)

Water heating gains (Table 5)

(72)m=	84.16	81.6	76.56	69.94	65.41	59.3	54.64	61.24	63.99	70.83	78.47	82.05	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	382.97	380.39	366.33	344.12	321.62	299.95	286.32	292.94	304.7	327.12	352.74	371.88	(73)

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6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.62	x	10.63	x	0.63	x	0.7	=	10.53	(74)
North	0.9x	0.77	x	1.62	x	20.32	x	0.63	x	0.7	=	20.12	(74)
North	0.9x	0.77	x	1.62	x	34.53	x	0.63	x	0.7	=	34.19	(74)
North	0.9x	0.77	x	1.62	x	55.46	x	0.63	x	0.7	=	54.92	(74)
North	0.9x	0.77	x	1.62	x	74.72	x	0.63	x	0.7	=	73.98	(74)
North	0.9x	0.77	x	1.62	x	79.99	x	0.63	x	0.7	=	79.2	(74)
North	0.9x	0.77	x	1.62	x	74.68	x	0.63	x	0.7	=	73.94	(74)
North	0.9x	0.77	x	1.62	x	59.25	x	0.63	x	0.7	=	58.66	(74)
North	0.9x	0.77	x	1.62	x	41.52	x	0.63	x	0.7	=	41.11	(74)
North	0.9x	0.77	x	1.62	x	24.19	x	0.63	x	0.7	=	23.95	(74)
North	0.9x	0.77	x	1.62	x	13.12	x	0.63	x	0.7	=	12.99	(74)
North	0.9x	0.77	x	1.62	x	8.86	x	0.63	x	0.7	=	8.78	(74)
East	0.9x	0.77	x	2.59	x	19.64	x	0.63	x	0.7	=	15.55	(76)
East	0.9x	0.77	x	0.86	x	19.64	x	0.63	x	0.7	=	5.16	(76)
East	0.9x	0.77	x	2.59	x	38.42	x	0.63	x	0.7	=	30.41	(76)
East	0.9x	0.77	x	0.86	x	38.42	x	0.63	x	0.7	=	10.1	(76)
East	0.9x	0.77	x	2.59	x	63.27	x	0.63	x	0.7	=	50.08	(76)
East	0.9x	0.77	x	0.86	x	63.27	x	0.63	x	0.7	=	16.63	(76)
East	0.9x	0.77	x	2.59	x	92.28	x	0.63	x	0.7	=	73.04	(76)
East	0.9x	0.77	x	0.86	x	92.28	x	0.63	x	0.7	=	24.25	(76)
East	0.9x	0.77	x	2.59	x	113.09	x	0.63	x	0.7	=	89.52	(76)
East	0.9x	0.77	x	0.86	x	113.09	x	0.63	x	0.7	=	29.72	(76)
East	0.9x	0.77	x	2.59	x	115.77	x	0.63	x	0.7	=	91.64	(76)
East	0.9x	0.77	x	0.86	x	115.77	x	0.63	x	0.7	=	30.43	(76)
East	0.9x	0.77	x	2.59	x	110.22	x	0.63	x	0.7	=	87.24	(76)
East	0.9x	0.77	x	0.86	x	110.22	x	0.63	x	0.7	=	28.97	(76)
East	0.9x	0.77	x	2.59	x	94.68	x	0.63	x	0.7	=	74.94	(76)
East	0.9x	0.77	x	0.86	x	94.68	x	0.63	x	0.7	=	24.88	(76)
East	0.9x	0.77	x	2.59	x	73.59	x	0.63	x	0.7	=	58.25	(76)
East	0.9x	0.77	x	0.86	x	73.59	x	0.63	x	0.7	=	19.34	(76)
East	0.9x	0.77	x	2.59	x	45.59	x	0.63	x	0.7	=	36.09	(76)
East	0.9x	0.77	x	0.86	x	45.59	x	0.63	x	0.7	=	11.98	(76)
East	0.9x	0.77	x	2.59	x	24.49	x	0.63	x	0.7	=	19.38	(76)
East	0.9x	0.77	x	0.86	x	24.49	x	0.63	x	0.7	=	6.44	(76)
East	0.9x	0.77	x	2.59	x	16.15	x	0.63	x	0.7	=	12.78	(76)
East	0.9x	0.77	x	0.86	x	16.15	x	0.63	x	0.7	=	4.24	(76)

South	0.9x	0.77	x	2.14	x	46.75	x	0.63	x	0.7	=	30.58	(78)
South	0.9x	0.77	x	2.14	x	76.57	x	0.63	x	0.7	=	50.08	(78)
South	0.9x	0.77	x	2.14	x	97.53	x	0.63	x	0.7	=	63.79	(78)
South	0.9x	0.77	x	2.14	x	110.23	x	0.63	x	0.7	=	72.09	(78)
South	0.9x	0.77	x	2.14	x	114.87	x	0.63	x	0.7	=	75.13	(78)
South	0.9x	0.77	x	2.14	x	110.55	x	0.63	x	0.7	=	72.3	(78)
South	0.9x	0.77	x	2.14	x	108.01	x	0.63	x	0.7	=	70.64	(78)
South	0.9x	0.77	x	2.14	x	104.89	x	0.63	x	0.7	=	68.6	(78)
South	0.9x	0.77	x	2.14	x	101.89	x	0.63	x	0.7	=	66.63	(78)
South	0.9x	0.77	x	2.14	x	82.59	x	0.63	x	0.7	=	54.01	(78)
South	0.9x	0.77	x	2.14	x	55.42	x	0.63	x	0.7	=	36.24	(78)
South	0.9x	0.77	x	2.14	x	40.4	x	0.63	x	0.7	=	26.42	(78)
Rooflights	0.9x	1	x	1.33	x	47.01	x	0.63	x	0.7	=	49.63	(82)
Rooflights	0.9x	1	x	1.33	x	83.9	x	0.63	x	0.7	=	88.58	(82)
Rooflights	0.9x	1	x	1.33	x	122.73	x	0.63	x	0.7	=	129.57	(82)
Rooflights	0.9x	1	x	1.33	x	161.74	x	0.63	x	0.7	=	170.76	(82)
Rooflights	0.9x	1	x	1.33	x	187.38	x	0.63	x	0.7	=	197.83	(82)
Rooflights	0.9x	1	x	1.33	x	188.06	x	0.63	x	0.7	=	198.54	(82)
Rooflights	0.9x	1	x	1.33	x	180.51	x	0.63	x	0.7	=	190.58	(82)
Rooflights	0.9x	1	x	1.33	x	161.54	x	0.63	x	0.7	=	170.54	(82)
Rooflights	0.9x	1	x	1.33	x	136.5	x	0.63	x	0.7	=	144.11	(82)
Rooflights	0.9x	1	x	1.33	x	95.08	x	0.63	x	0.7	=	100.38	(82)
Rooflights	0.9x	1	x	1.33	x	57.06	x	0.63	x	0.7	=	60.24	(82)
Rooflights	0.9x	1	x	1.33	x	39.72	x	0.63	x	0.7	=	41.93	(82)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.45	199.28	294.26	395.07	466.18	472.11	451.37	397.63	329.45	226.41	135.29	94.16	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	494.41	579.67	660.59	739.19	787.8	772.06	737.69	690.57	634.15	553.53	488.04	466.04	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.95	0.87	0.7	0.53	0.59	0.83	0.97	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.71	19.88	20.16	20.5	20.79	20.95	20.99	20.98	20.87	20.5	20.04	19.69	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.92	19.92	19.92	19.94	19.94	19.95	19.95	19.95	19.94	19.94	19.93	19.93	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.93	0.82	0.61	0.41	0.46	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

TER WorkSheet: New dwelling design stage

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
(90)m=	18.21	18.46	18.85	19.36	19.73	19.92	19.95	19.94	19.85	19.36	18.7	18.18		(90)

fLA = Living area ÷ (4) = 0.23 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.56	18.79	19.16	19.63	19.98	20.16	20.19	20.19	20.09	19.62	19.01	18.53	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	0.99	0.97	0.93	0.82	0.63	0.44	0.49	0.77	0.95	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	491.97	573.41	643.2	685.66	644.99	483.53	324.19	339.18	486.26	526.41	483.09	464.29	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1347.38	1308.62	1188.81	993.13	764.64	506.81	327.4	344.65	548.62	833.3	1106.17	1338.22	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3173.97 (98)

Space heating requirement in kWh/m²/year 40.48 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.4	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	636.43	494.06	405.93	221.38	89.01	0	0	0	0	228.33	448.62	650.21		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	681.4	528.97	434.62	237.02	95.3	0	0	0	0	244.47	480.32	696.15		
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													3398.26	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

Output from water heater (calculated above)

200.96	176.06	183.18	162.47	157.3	138.54	132.73	147.96	149.6	170.35	181.84	196.23

Efficiency of water heater 80.3 (216)

(217)m=	87.75	87.51	87	85.83	83.68	80.3	80.3	80.3	80.3	85.79	87.24	87.84	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	229.01	201.19	210.55	189.29	187.98	172.53	165.29	184.27	186.3	198.57	208.45	223.4	

Total = $Sum(219a)_{1...12}$ = 2356.83 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3398.26	
Water heating fuel used			2356.83	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			357.88	(232)
Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =			6268.27	(338)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	734.02	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	509.08	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1243.1	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	185.74	(268)
Total CO2, kg/year		sum of (265)…(271) =		1467.76	(272)

TER = 18.72 (273)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 February 2021

Property Details: HOUSE E - FINAL

Dwelling type:	Semi-detached House
Located in:	England
Region:	South East England
Cross ventilation possible:	Yes
Number of storeys:	2
Front of dwelling faces:	North
Overshading:	Average or unknown
Overhangs:	None
Thermal mass parameter:	Indicative Value Medium
Night ventilation:	False
Blinds, curtains, shutters:	Dark-coloured curtain or roller blind
Ventilation rate during hot weather (ach):	8 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient:	534	**(P1)**
Transmission heat loss coefficient:	57.1	
Summer heat loss coefficient:	591.1	**(P2)**

Overhangs:

Orientation:	**Ratio:**	**Z_overhangs:**
North (W1-2 FRONT N)	0	1
East (W3 - SIDE E)	0	1
East (W4 - SIDE E)	0	1
South (W5 - REAR S)	0	1
South (RW1-2 REAR S)	0	1

Solar shading:

Orientation:	**Z blinds:**	**Solar access:**	**Overhangs:**	**Z summer:**	
North (W1-2 FRONT N)	0.98	1	1	0.98	**(P8)**
East (W3 - SIDE E)	0.98	1	1	0.98	**(P8)**
East (W4 - SIDE E)	0.98	1	1	0.98	**(P8)**
South (W5 - REAR S)	0.98	1	1	0.98	**(P8)**
South (RW1-2 REAR S)	0.98	1	1	0.98	**(P8)**

Solar gains:

Orientation		**Area**	**Flux**	**g_**	**FF**	**Shading**	**Gains**	
North (W1-2 FRONT N)	1 x	3.24	86.66	0.63	0.8	0.98	125.45	
East (W3 - SIDE E)	1 x	2.59	124.8	0.63	0.8	0.98	144.42	
East (W4 - SIDE E)	1 x	0.86	124.8	0.63	0.8	0.98	47.95	
South (W5 - REAR S)	1 x	2.14	118.4	0.63	0.8	0.98	113.21	
	1 x	2.66	202.31	0.63	0.8	0.98	240.45	
						Total	671.47	**(P3/P4)**

Internal gains:

	June	**July**	**August**	
Internal gains	422.24	404.7	412.74	
Total summer gains	1133.38	1076.17	1007.8	**(P5)**
Summer gain/loss ratio	1.92	1.82	1.7	**(P6)**
Mean summer external temperature (South East England)	15.4	17.4	17.5	

SAP 2012 Overheating Assessment

Thermal mass temperature increment	0.25	0.25	0.25	
Threshold temperature	17.57	19.47	19.45	**(P7)**
Likelihood of high internal temperature	**Not significant**	**Not significant**	**Not significant**	

Assessment of likelihood of high internal temperature: Not significant

APPENDIX E: Predicted EPCS

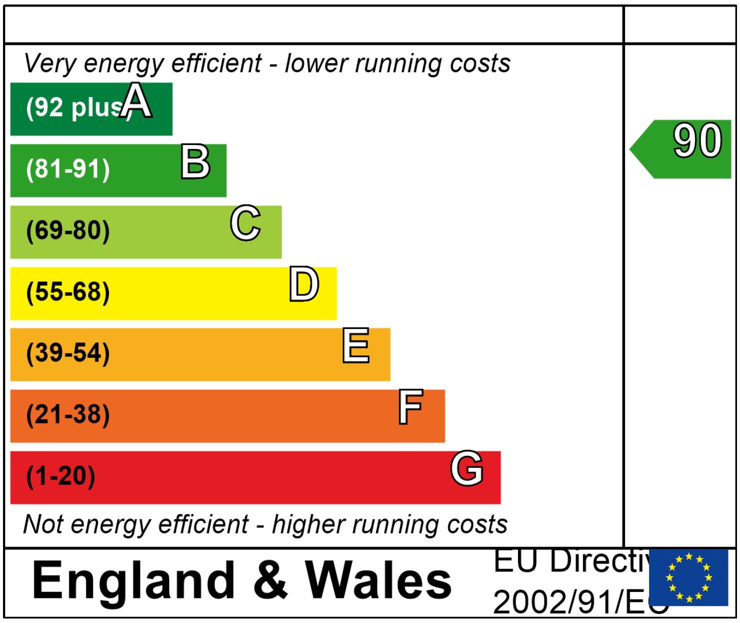
Predicted Energy Assessment

Woodwell Cottage P2 Woodwell Road BRISTOL BS11 9XU	Dwelling type: Date of assessment: Produced by: Total floor area:	Detached House 24 February 2021 Jemma Mclaughlan 81.5 m²

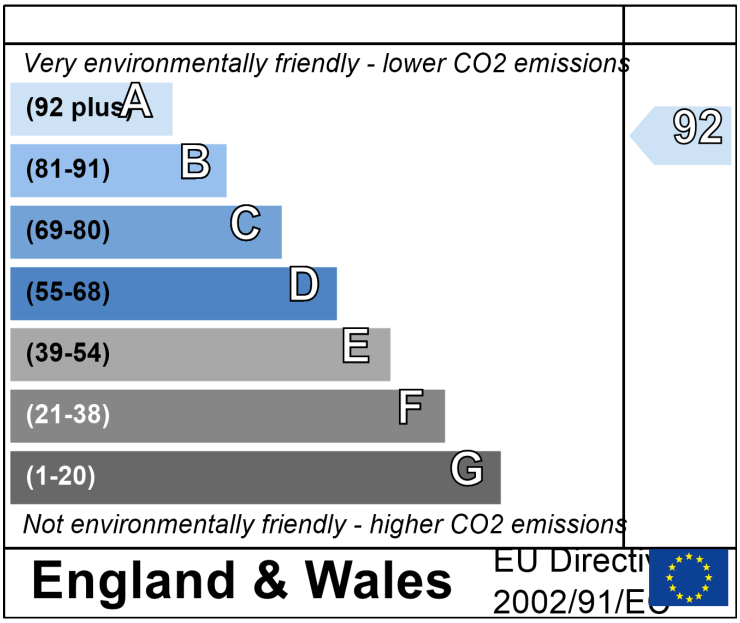
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

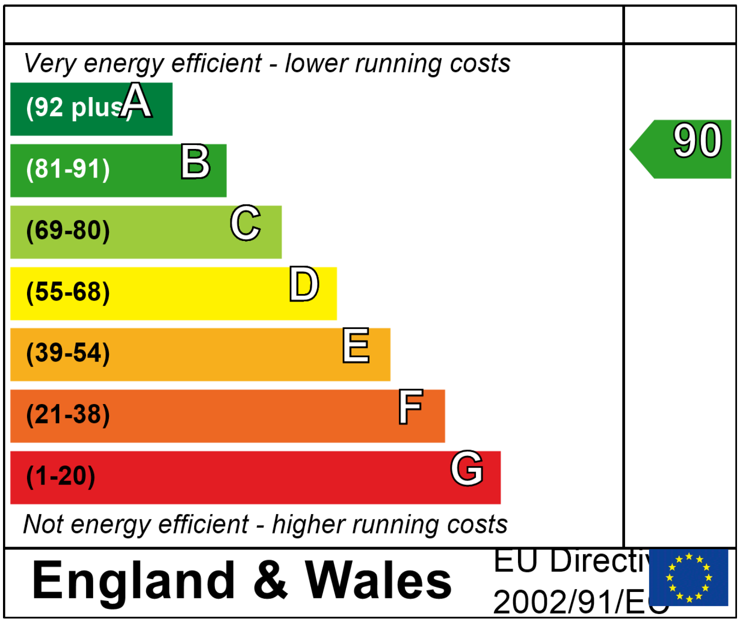
Predicted Energy Assessment

Woodwell Cottage P2		Dwelling type:	Semi-detached House
Woodwell Road		Date of assessment:	24 February 2021
BRISTOL		Produced by:	Jemma Mclaughlan
BS11 9XU		Total floor area:	78.4 m²

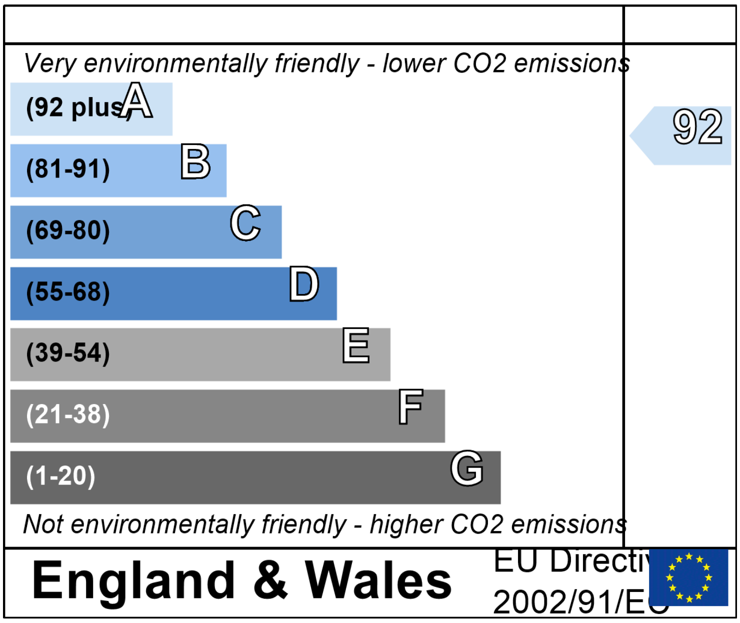
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

Predicted Energy Assessment

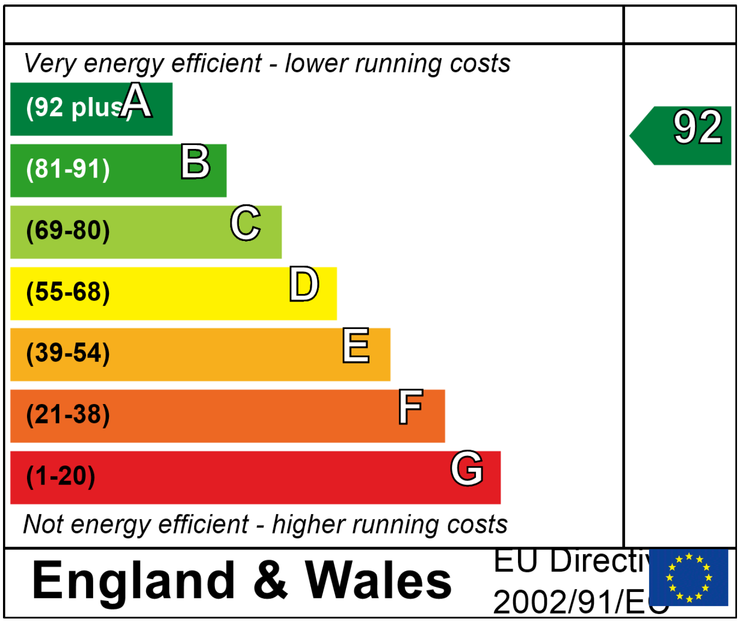
Woodwell Cottage P2
Woodwell Road
BRISTOL
BS11 9XU

Dwelling type:	Semi-detached House
Date of assessment:	24 February 2021
Produced by:	Jemma Mclaughlan
Total floor area:	78.4 m²

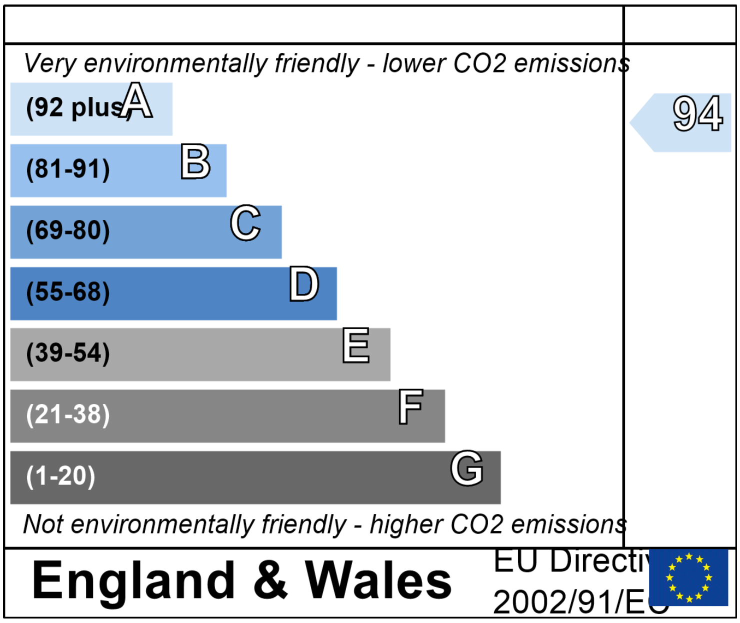
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

Energy Efficiency Rating



Environmental Impact (CO_2) Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

APPENDIX F: Feasibility Work Sheets

SITE WIDE ENERGY DEMAND, CO2 & COST ANALYSIS - WOODWELL P2

OPTION 2 - ASHP	HOUSE C	HOUSE D	HOUSE E	SITE TOTAL	CURRENT CARBON FACTORS - SAP 2012		PREDICTED CARBON FACTORS - SAP 10	
Stage 1 - BASELINE Energy Demand	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1825.6	1800.4	1800.4	5426.3	0.216	1172.1	0.210	1139.5
Space Heating (211)	4195.5	3892.0	3892.0	11979.4	0.216	2587.6	0.210	2515.7
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	385.4	383.8	383.8	1153.0	0.519	598.4	0.233	268.7
TOTAL	**6481.5**	**6151.2**	**6151.2**	**18783.8**		**4474.8**		**3976.3**
Stage 2 - IMPROVED Energy Demand Following Energy Efficiency Measures	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1827.2	1801.4	1801.4	5430.0	0.216	1172.9	0.210	1140.3
Space Heating (211)	3574.5	3479.5	3479.5	10533.5	0.216	2275.2	0.210	2212.0
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
TOTAL	**5827.1**	**5704.8**	**5704.8**	**17236.7**		**4108.9**		**3649.0**
Stage 3 - FINAL Energy Demand following Renewable or LZC Technologies	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1354.1	1339.9	1339.9	4033.8	0.519	2093.6	0.233	939.9
Space Heating (211)	1287.1	1233.2	1233.2	3753.5	0.519	1948.1	0.233	874.6
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
PV	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
TOTAL	**2991.5**	**2922.0**	**2922.0**	**8835.5**		**4585.6**		**2058.7**

CO^2 REDUCTION SUMMARY - SAP2012

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	4474.8
Improved emissions after application of energy efficiency measures.	4108.9
CO2 Reduction from application of energy efficiency measures.	365.9
Improved emissions after incorporation of efficient energy supply	4108.9
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	4585.6
CO2 Reduction from incorporation of renewable energy	-476.7
CO2 displaced in total	**-110.8**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**-11.6%**
% CO2 displaced in total	**-2.5%**

ENERGY REDUCTION SUMMARY - SAP2012

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	8835.5
Energy Saved from incorporation of renewable energy technology.	8401.2
Energy Demand reduction in total	**9948.3**
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	**48.7%**
% Energy Demand reduction in total	53.0%

CO^2 REDUCTION SUMMARY - SAP10

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	3976.3
Improved emissions after application of energy efficiency measures.	3649.0
CO2 Reduction from application of energy efficiency measures.	327.3
Improved emissions after incorporation of efficient energy supply	3649.0
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	2058.7
CO2 Reduction from incorporation of renewable energy	1590.3
CO2 displaced in total	**1917.6**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**43.6%**
% CO2 displaced in total	**48.2%**

ENERGY REDUCTION SUMMARY - SAP10

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	8835.5
Energy Saved from incorporation of renewable energy technology.	8401.2
Energy Demand reduction in total	**9948.3**
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	**48.7%**
% Energy Demand reduction in total	53.0%

SITE WIDE ENERGY DEMAND, CO2 & COST ANALYSIS - WOODWELL P2

OPTION 3 - SHW	HOUSE C	HOUSE D	HOUSE E	SITE TOTAL	CURRENT CARBON FACTORS - SAP 2012		PREDICTED CARBON FACTORS - SAP 10	
Stage 1 - BASELINE Energy Demand	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1825.6	1800.4	1800.4	5426.3	0.216	1172.1	0.210	1139.5
Space Heating (211)	4195.5	3892.0	3892.0	11979.4	0.216	2587.6	0.210	2515.7
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	385.4	383.8	383.8	1153.0	0.519	598.4	0.233	268.7
TOTAL	**6481.5**	**6151.2**	**6151.2**	**18783.8**		**4474.8**		**3976.3**
Stage 2 - IMPROVED Energy Demand Following Energy Efficiency Measures	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Total Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1827.2	1801.4	1801.4	5430.0	0.216	1172.9	0.210	1140.3
Space Heating (211)	3574.5	3479.5	3479.5	10533.5	0.216	2275.2	0.210	2212.0
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	75.0	75.0	75.0	225.0	0.519	116.8	0.233	52.4
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
TOTAL	**5827.1**	**5704.8**	**5704.8**	**17236.7**		**4108.9**		**3649.0**
Stage 3 - FINAL Energy Demand following Renewable or LZC Technologies	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Energy Demand (kWh/yr)**	**Carbon Emission Factor (SAP 2012)**	**Total CO2 (kgCO2/yr)**	**Carbon Emission Factor (SAP10)**	**Total CO2 (kgCO2/yr)**
Hot Water (219)	1194.7	1179.3	1179.3	3553.3	0.216	767.5	0.210	746.2
Space Heating (211)	3485.0	3355.8	3355.8	10196.6	0.216	2202.5	0.210	2141.3
Secondary Heating (215)	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
Pumps & Fans (231)	125.0	125.0	125.0	375.0	0.519	194.6	0.233	87.4
Lighting (232)	350.4	348.9	348.9	1048.2	0.519	544.0	0.233	244.2
PV	0.0	0.0	0.0	0.0	0.519	0.0	0.233	0.0
TOTAL	**5155.2**	**5009.0**	**5009.0**	**15173.1**		**3708.6**		**3219.1**

CO^2 REDUCTION SUMMARY - SAP2012

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	4474.8
Improved emissions after application of energy efficiency measures.	4108.9
CO2 Reduction from application of energy efficiency measures.	365.9
Improved emissions after incorporation of efficient energy supply	4108.9
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	3708.6
CO2 Reduction from incorporation of renewable energy	400.3
CO2 displaced in total	**766.2**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**9.7%**
% CO2 displaced in total	**17.1%**

ENERGY REDUCTION SUMMARY - SAP2012

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	15173.1
Energy Saved from incorporation of renewable energy technology.	2063.6
Energy Demand reduction in total	3610.7
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	12.0%
% Energy Demand reduction in total	19.2%

CO^2 REDUCTION SUMMARY - SAP10

Summary of CO2 Emission Reductions	Total CO2 emissions (kgCO2/year)
Baseline emissions	3976.3
Improved emissions after application of energy efficiency measures.	3649.0
CO2 Reduction from application of energy efficiency measures.	327.3
Improved emissions after incorporation of efficient energy supply	3649.0
CO2 Reduction from efficient Energy Supply.	0.0
Final emissions after incorporation of renewable energy	3219.1
CO2 Reduction from incorporation of renewable energy	429.9
CO2 displaced in total	**757.2**
Summary of CO2 Emission Reductions	**Total reduction (%)**
% CO2 displaced by energy efficiency measures	8.2%
% CO2 displaced by efficient supply of energy	0.00%
% CO2 displaced by renewable energy	**11.8%**
% CO2 displaced in total	**19.0%**

ENERGY REDUCTION SUMMARY - SAP10

Summary of Energy Reduction:	Total Regulated Energy Use (kWh/yr):
Baseline Energy Demand.	18783.8
Improved Energy Demand after application of energy efficiency measures.	17236.7
Energy Saved from application of Energy Efficiency Measures.	1547.1
Improved Energy Demand after incorporation of efficient energy supply.	17236.7
Energy Saved from incorporation of efficient energy supply.	0.0
Improved Energy Demand after incorporation of renewable energy technology.	15173.1
Energy Saved from incorporation of renewable energy technology.	2063.6
Energy Demand reduction in total	3610.7
Summary of Energy Reduction:	Total Energy Reduction (%):
% Energy Demand reduction from efficiency measures	8.2%
% Energy Demand reduction by efficient supply of energy	0.00%
% Energy Demand reduction by renewable energy	12.0%
% Energy Demand reduction in total	19.2%