



APPENDIX C:

ENERGY STRATEGY REPORT

Phase 3 St Michael's Manchester

Energy Strategy Report
Ref: P1785-ES-001 Rev D



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AMENDMENT HISTORY



REVISION	DESCRIPTION	DATE	AUTHOR	CHECKED
A	Initial Issue	Aug 2022	C. Pearson	B. Duckworth
B	ENV Statement Separated	Nov 2022	C. Pearson	B. Duckworth
C	Comments Addressed	Dec 2022	C. Pearson	B. Duckworth
D	Additional Floors Added	June 2023	C. Pearson	B. Duckworth

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1 EXECUTIVE SUMMARY

The proposed development St Michael's is located within Manchester city centre. As such the policies detailed in the Manchester Core Strategy must be adhered to. This report will directly address policies EN4, EN6 and EN8 in respect of Phase3 which includes the hotel, restaurant and office space.

The methodology for this report is to take a 'fabric first' approach as set out in Manchester City Councils Core Strategy, making improvements to the envelope first, reviewing the results due to these fabric improvements and then reviewing suitable technologies to enhance this design philosophy where feasible. As the building notice for this development was submitted before June 15th, 2022, and works will commence on-site before June 15th, 2023, Transitional Arrangements apply, therefore the results in this report will be based on Building Regulations 2012. The proposed fabric specification is described in Table 1 below.

Table 1 Building Fabric Specification

Building Fabric			
Element	L1A: 2013 Limiting U-values (W/m².k)	L1A: 2013 Notional U-values (W/m².k)	Proposed U-values (W/m².k)
Floors	0.25	0.13	0.18
External Walls	0.30	0.18	0.24
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.15
Windows	2.00	1.40	1.1 (g-value 0.4)
Doors	2.00	1.0	N/A
Y – value (W/m².k)	0.15	~0.05	~0.07 – 0.12
Air permeability (m²/h.m² @ 50 pa)			
All dwellings	10.0	5.0	5.0
Thermal Bridging Details			
External Junction Type		Linear Thermal Transmittance (Ψ)	Note
E1 Lintel		0.5	Accredited Detail
E4 Jamb		0.05	Accredited Detail
E6 Intermediate Floor Within Dwelling		0.07	Accredited Detail
E7 Party Floor Between Dwellings (flats)		0.07	Accredited Detail
E9 Balcony between dwellings, wall insulation continuous		0.02	Accredited Detail
E14 Flat Roof		0.08	Accredited Detail
E18 Party Wall Between Dwellings		0.06	Accredited Detail
Party Wall Junction Type		Linear Thermal Transmittance (Ψ)	Note
P3 Intermediate Floor Between Dwellings		0	Default Detail
Thermal Mass Parameter (TMP)			
Light 100 - 250 kJ/m²K			

Proposed fabric values are lower than the limiting/notional values and accredited construction details have been used throughout to improve the Y-value. This is key to the fabric first approach which aims to reduce annual CO₂ production in line with the policies of the Manchester Core Strategy.

Regarding the systems used, the development will utilise low carbon Air Source Heat Pump technology to provide both heating and cooling, hot water for non-domestic areas will also be provided by ASHP technology. Domestic hot water will be provided electric immersion cylinders and mechanical ventilation with heat recovery (MVHR) will be used for ventilation.

A breakdown of systems is provided in Table 2 below.

Table 2 Systems by General Area Type

General Area	Heating/Cooling	Ventilation	Hot Water
GF non-domestic	VRF ASHP	MVHR	Elec Water Heater
Office Area	VRF ASHP	MVHR	Elec Water Heater
Hotel Area	VRF ASHP	MVHR	QAHV ASHP
Domestic Area	VRF ASHP	MVHR	Electric Immersion
Domestic Communal	Panel Heater	N/A	N/A
Non-Domestic Circulation	Panel Heater	N/A	N/A

Utilising an all-electric strategy combined with the Fabric Energy Efficiency improvements will allow the development to achieve the required CO₂ reduction dictated by the Manchester Core Strategy. Currently the portion of renewable energy supplying the national grid is circa 48% therefore as the grid becomes greener so will developments that primarily use grid electricity.

In addition to efficient systems, consideration has been given to the reduction of mains potable water usage through efficient water fixtures. This is further detailed in section 4.5 however potable water demand is to be reduced to <16 litres/person/day as per the requirement within Building Regulations.

There is an emphasis on fully utilising electric systems in this recommendation owing to the implementation of Part L 2021, which incorporates major changes to the Fuel Carbon Factors for each fuel type and effectively brings grid electricity in line with gas. Whilst Transitional Arrangements apply to this development and final lodgement will ultimately be done on 2012 Building Regulations; this Energy Strategy is designed with the carbon factors of 2021 Building Regulations in mind. Thereby addressing the carbon reduction requirements of the Manchester Core Strategy more accurately and better representing the developments carbon efficiency.

This is further discussed in Section 2.5.1 of this report, the primary benefit of the decarbonising of grid electricity is that it makes all-electric schemes far more efficient in terms of CO₂ reduction and opens up the possibility of achieving zero carbon in the future as the portion of renewable energy being added to the grid increases. An all-electric strategy has therefore been pursued to take advantage of this benefit.

An all-electric system has been pursued over a wet system as the use of a wet heating system, connected to the district heating source, would require additional plant space at ground floor level to incorporate plate heat exchangers, large buffer vessels, pumps, pressurisation units. This would lose key space at ground floor level as well as expand the amount of plant for the development to maintain.

For the whole development, the following results have been obtained, based on an area weighted average calculation to produce a single result for the full building. Please note that the SAP10 calculation software has not been fully released at this stage, therefore these results are subject to change as the final version of the software becomes available:

Table 3 Building Regulations Part L 2012 Results

Target Emission Rate vs Dwelling Emission Rate	
Combined Target Carbon Dioxide Emission Rate (TER)	26.48 kgCO ₂ /m ² .yr
Combined Dwelling Carbon Dioxide Emission Rate (BER)	24.97 kgCO ₂ /m ² .yr
% Reduction	5.72%
Target Fabric Energy Efficiency vs Dwelling Fabric Energy Efficiency	
Combined Target Fabric Energy Efficiency (TFEE)	38.99 kWh/m ²
Combined Dwelling Fabric Energy Efficiency (DFEE)	34.73 kWh/m ²
% Reduction	10.93%

Table 4 Estimated Building Regulations Part L 2021 Results

Target Emission Rate vs Dwelling Emission Rate	
Combined Target Carbon Dioxide Emission Rate (TER)	8.67 kgCO ₂ /m ² .yr
Combined Dwelling Carbon Dioxide Emission Rate (BER)	6.74 kgCO ₂ /m ² .yr
% Reduction	22.28%

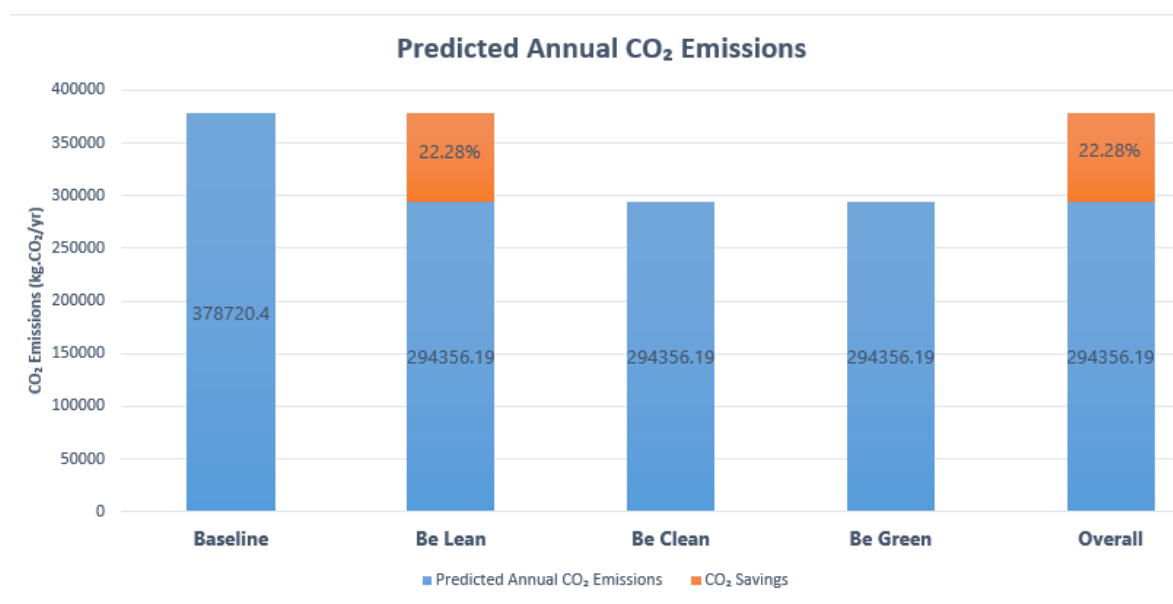
A 22.28% overall reduction in CO₂ emissions can be observed. The Manchester Core Strategy requires a 15% improvement over Part L 2010 Building Regulations. These regulations have been superseded by 2013 and 2021 Building Regulations which collectively are a 37% betterment over 2010 Building Regulations by default. Therefore, by achieving a CO₂ reduction of 22.28%, this equates to a 59.28% improvement over 2010 Building Regulations and offers full compliance with the requirements of the Manchester Core Strategy.

Figure's 1 & 2 below summarises the carbon performance at each stage of the Energy Hierarchy.

Figure 1: Overall Carbon Emissions per Energy Hierarchy Stage Part L 2012 Building Regulations



Figure 2: Overall Carbon Emissions per Energy Hierarchy Stage Part L 2021 Building Regulations



2 INTRODUCTION

2.1 PURPOSE

NOVO Integration Ltd has been appointed as Energy Consultants to produce an Energy and Environmental Standards Statement for the St Michael's development, Manchester.

This is to support the scheme design process, demonstrate Building Regulations Part L compliance and to achieve the applicable planning policies set out in the Manchester Core Strategy.

Figure 3: St Michael's Manchester



This report will outline the following:

1. Assess Phase 3 of the proposed development site's estimated CO₂ emissions, it will look into the feasibility of Low Zero Carbon technologies, examining the following aspects relative to LZC/renewable technologies:
 - Energy generated by Renewable/Low Zero Carbon Technologies (LZC)
 - Feasibility assessment for each Renewable/Low Zero Carbon Technologies (LZC)
 - Local Planning Requirements
2. The proposed building fabric and Low Zero Carbon (LZC) design strategy and analysis calculations, with respect to the Standard Assessment Procedure (SAP) and Simplified Building Energy Model (SBEM). Demonstration of how the design is compliant against Part L1/2A Buildings Regulations.

2.2 BACKGROUND POLICY DOCUMENTS

The following statements and regulatory guidelines form the policy background to this energy strategy:

- The Kyoto Protocol at the United Nations.
- Framework Convention on Climate Change as negotiated in December 1997 has come into effect on 16 February 2005 following the ratification of the agreement by Russia on 18 November 2004. The Burden Sharing Agreement of the EU mandates a 12.5% reduction in greenhouse gas emissions for the UK by 2008 - 12.
- The Department of Transport and Industry White Paper, titled "Our Energy Future - Creating a Low Carbon Economy", spells out a target for 10% of electricity to be from renewable sources nationally by 2010 and twice this by 2020.
- National Policy Objectives in regard to renewable energy Planning Policy Statement 22: Renewable energy guidance for local governing bodies concerning implementation of renewable energy technologies through appropriate planning.
- The United Kingdom has made commitments that extend beyond this requirement. National Targets are for a reduction to 20% below 1990 CO₂ levels by 2010 and a 60% reduction by 2050.
- Integrating renewable energy into new developments: Toolkit for planners, developers and consultants, September 2004.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new buildings other than dwellings.
- The Building Regulations 2013 - Approved Document L - Conservation of Fuel and Power in new dwellings.
- Manchester Core Strategy 2012-2027
- Guide to Development in Manchester SPD (2007)
- Manchester City Council Climate Change Framework (2020-2025)
- RIBA 2030 Climate Challenge
- SAP 10 Technical Paper S10TP-15 CO₂ and Primary Energy for SAP
- Approved Document Part L Volume 1: Dwellings 2021
- Approved Document Part L Volume 2: Buildings other than dwellings 2021
- National Planning Policy Framework (July 2021)

The National Planning Policy Framework is a key part of our reforms to make the planning system less complex and more accessible, to protect the environment and to promote sustainable growth. In particular point A of paragraph 16 which states the following:

Plans should:

- a) be prepared with the objective of contributing to the achievement of sustainable development.*
- b) be prepared positively, in a way that is aspirational but deliverable*
- c) be shaped by early, proportionate, and effective engagement between plan makers and communities, local organisations, businesses, infrastructure providers and operators and statutory consultees*
- d) contain policies that are clearly written and unambiguous, so it is evident how a decision maker should react to development proposals*
- e) be accessible through the use of digital tools to assist public involvement and policy presentation; and*

- f) *serve a clear purpose, avoiding unnecessary duplication of policies that apply to a particular area (including policies in this Framework, where relevant).*

Another key point of the NPPF is paragraph 8, point C which states the following:

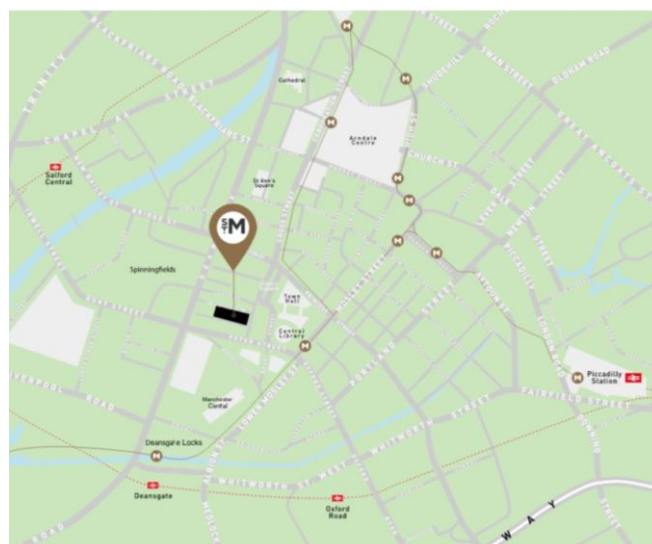
Achieving sustainable development means that the planning system has three overarching objectives, which are interdependent and need to be pursued in mutually supportive ways (so that opportunities can be taken to secure net gains across each of the different objectives):

- a) *an economic objective – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;*
- b) *a social objective – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and*
- c) *an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.*

2.3 SITE DESCRIPTION

The site is located in the centre of Manchester, the surrounding area is a mix of non-domestic and domestic spaces. It is in close proximity to iconic buildings such as the Town hall and Central Library. Being a city centre location there is a strong presence of local retail and various amenity, also nearby to the development is the Spinningfields Business District, Civic Quarter and Chinatown.

Figure 4: Ariel View



2.4 PLANNING POLICY

2.4.1 Local Policy

The locality of the development site means it falls under the jurisdiction of Manchester City Council. As such the policies adopted by Manchester City Council must be adhered to.

The document that details Manchester's strategy for development is 'Manchester's Local Development Framework – Core Strategy Development Plan Document', throughout the remainder of this report it shall be referred to as Manchester Core Strategy. The Core Strategy was adopted 11th July 2012.

Policy EN 4:

Reducing CO₂ Emissions by Enabling Low and Zero Carbon Development

The Council will seek to reduce fuel poverty and decouple growth in the economy, growth in CO₂ emissions, and rising fossil fuel prices, through the following actions:

- All developments must follow the principle of the Energy Hierarchy, being designed to reduce the need for energy through design features that provide passive heating, natural lighting and cooling*
- To reduce the need for energy through energy efficient features such as improved insulation and glazing*
- To meet residual energy requirements through the use of low or zero carbon energy generating technologies*
- Wherever possible new development and retrofit projects, including energy generation plant, must be located and designed in a manner that allows advantage to be taken of opportunities for low and zero carbon energy supplies*
- Where possible new development and retrofit projects will be used as a mechanism to help improve energy efficiency and provide low and zero carbon energy supplies to existing buildings*
- Where appropriate new development and retrofit projects will be required to connect to and/or make contributions to low or zero carbon energy schemes and/or to incorporate provision to enable future connection to any existing / potential decentralised energy schemes*

Policy EN 6

Target Framework for CO₂ reductions from low or zero carbon energy supplies

Applications for residential development of 10 or more units and all other development over 1,000 sq m will be expected as a minimum to meet the target shown in Tables 12.1 or 12.2, unless this can be shown not to be viable. This should be demonstrated through an energy statement, submitted as part of the Design and Access Statement. Such a statement will be expected to set out the projected regulated energy demand and associated CO₂ emissions for all phases of the development.

Developments smaller than the above threshold but involving the erection of a building or substantial improvement to an existing building will also be expected to meet the minimum target, where viable, but will not be expected to submit an energy statement.

The target framework relates to three broad development locations and their potential for low and zero carbon, decentralised energy. The areas are defined as follows:

- Target 1 Network development areas: Locations where the proximity of new and existing buildings, the mix of uses and density of development provide the right conditions to support district heating (and cooling)*

- *Target 2 Electricity intense areas: Locations where the predominant building type has an all-electric fit-out such as retail units and leisure complexes*
- *Target 3 MICRO-GENERATION AREAS: Locations where lower densities and a fragmented mix of uses tend to mean that only building scale solutions are practical*

Policy EN 8:

Adaptation to Climate Change

The council outlines an indicative list of remedial actions for new developments in order to be adaptable to climate change in terms of design, layout, siting and function:

- *Minimisation of flood risk by appropriate siting, drainage, and treatment of surface areas to ensure rainwater permeability*
- *Reduction in urban heat island effect through the use of Green Infrastructure such as green roofs, green walls, increased tree cover and waterways*
- *The need to control overheating of buildings through passive design*
- *The opportunity to provide linked and diverse green space to enhance natural habitats which will assist species adaptation*

Domestic CO₂ emission targets

Table 12.1

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2: Electricity intense buildings	+15% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Non-domestic CO₂ emissions reduction targets

Table 12.2

Target	% Minimum requirement
Target 1: Network development area	CHP/district heating anchor or connection or where not feasible a 15% increase on Part L 2010
Target 2: Electricity intense buildings (applies to commercial uses with a high proportion of emissions from electricity use (>45kgCO ₂ /m ²))	+15% increase on Part L 2010
Target 3: Micro generation area	+15% increase on Part L 2010

Where the CO₂ emissions reduction required under any future revision to Part L of the building regulations become greater than the '% minimum requirement', the reduction required under building regulations would apply.

Where the Council identifies an 'allowable solution', for example within an energy proposals plan, that would produce higher carbon reductions at no extra cost than that of achieving the '% Minimum requirement' (or required under building regulations if greater) the higher percentage reduction will be required. The cost comparison is based on the cost of incorporating the 'allowable solution' at design stage.

The energy statement will be required to be submitted at the outset of any proposed development (outline application or before). Developers will be permitted to use green infrastructure elements such as green roofs, green walls, street trees and waterways to contribute to compliance with CO₂ mitigation, subject to the energy statement incorporating evidence such as modelling to demonstrate compliance.

Guidance on what the energy statement should contain and how to decide which target applies to a development proposal is given in appendix A.

The above policy states that this specific development requires a 15% betterment with CO₂ emission reduction over 2010 Building Regulations. However, the development will be constructed to adhere to 2013 Building Regulations whilst providing estimate Part L 2021 Building Regulations results.

There have been 2nr updates to Part L since the introduction of the above Policy target CO₂ reduction. The first being the Part L 2013 update and the second being the Part L 2021 update. The collective betterment of the 2nr Part L updates over Building regulations 2010 is 37% (6% from 2010 to 2013 and 31% from 2013 to 2021). Therefore, by achieving a pass under current 2021 Building Regulations the development will not only meet the required CO₂ reduction in Policy EN8 but exceed it by 22%.

Furthermore Section 4 Environmental Standards of the Manchester Supplementary Planning Document details the requirement for an Environmental Standards Statement highlighting a number of Environmental issues be addressed. These issues are addressed in Section 5 of this report.

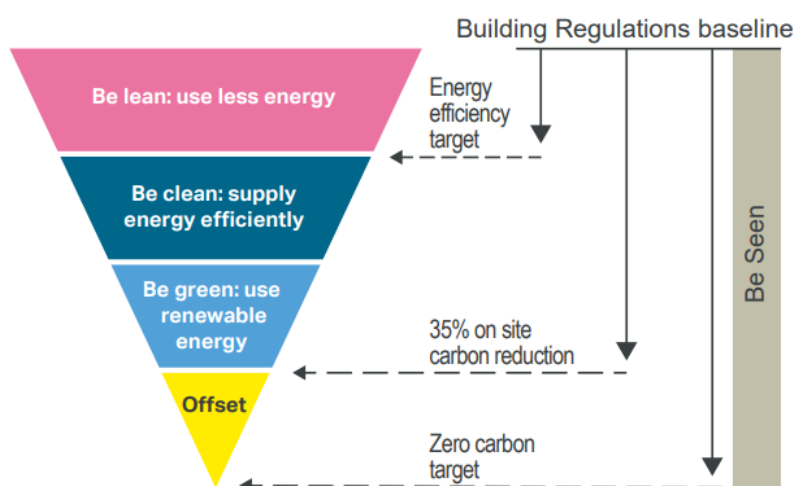
2.4.2 Energy Hierarchy

As part of the Sustainability and Energy analysis of the development Energy Hierarchy has been used as a means of structuring the sustainable design process.

We have taken this approach in order to properly address the Manchester Core Strategy Policies which promote low carbon design, assessment of connection to CHP and consideration of other low – zero carbon technologies.

An overview of the Energy Hierarchy is provided below:

Figure 5: Energy Hierarchy Diagram

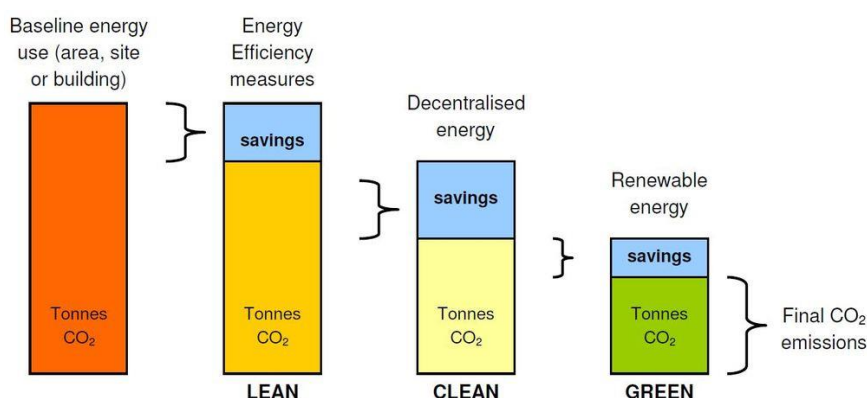


- Using less energy, in particular by adopting sustainable design and construction measures.
- Supplying energy efficiently, in particular by prioritising decentralised energy generation; and
- Using renewable energy.

The development Energy strategy has adopted the following design ethos:

- **BE LEAN** – By using less energy and taking into account the further energy efficiency measure in comparison to the baseline building.
- **BE CLEAN** – By supplying energy efficiently. The clean building looks at further carbon dioxide emission savings over the lean building by taking into consideration the use of decentralise energy via CHP.
- **BE GREEN** – By integrating renewable energy into the scheme which can further reduce the carbon dioxide emission rate.

Figure 6: Energy Hierarchy Example Graph



2.5 BUILDING REGULATIONS

Approved document L1A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

Approved document L1A – Conservation of fuel and Power sets the standard for carbon emissions for new dwellings and was revised last April 2014 (Part L: 2013). Dwellings will need to comply with the criteria set out in the document, as follows:

- 1) The predicted Dwelling CO₂ Emission Rate (DER) should not be greater than the Target CO₂ Emission Rate (TER).
- 2) The performance of the building fabric and fixed building services should be no more than the design limits set out in Table 2 of the approved Document.
- 3) The dwelling will have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer.
- 4) That the performance of dwellings as built comply with DER values achieved, including site testing or a representative sample of dwellings, demonstrating that the 'air permeability' rate achieved is as per that specified, or better.
- 5) The necessary provisions for energy efficient operation of dwellings are put in place, including operation and maintenance instructions

Approved document L2A (2013)– Conservation of fuel and Power sets the standard for carbon emissions for new buildings other than dwellings. Buildings will need to comply with the criteria set out in the document, as follows:

In order to demonstrate compliance with the requirements for Approved Document L2A (2013) there are five separate criteria that must be met.

The following briefly outlines each of the five criteria:

(i) Criterion 1 - Achieving the Buildings Emission Rate (BER)

To demonstrate compliance with Criterion 1 the actual building emission rate is compared to the notional building emission rate and must be at least equal.

The actual buildings emission rate is calculated when the building is modelled using approved software and the proposed construction values are detailed, for example, u-values, efficiency of M&E plant, etc. following this exercise the software will generate a notional building, the notional building has the same layout as the actual building, but the construction values and energy performance of the M&E equipment is pre-set, this allows the software to generate a target emission rate (TER) for the actual building, the TER is the anticipated emission rate from the notional building.

The BER is then compared to the TER and if it is equal to or lower than then the building is deemed to comply with Criterion 1.

This process needs to be completed and issued to Building Control at the "As-Designed" Stage to demonstrate to Building Control that the proposals for the building comply with the criteria.

(ii) Criterion 2 - Limits on Design Flexibility

Each element of the construction has pre-set performance limits within the document; these are generally split into 2 categories, an average value and an upper limit value which cannot be exceeded.

To demonstrate compliance with criterion 2 then criterion 1 must be achieved with no individual element exceeding the upper limit set for performance.

(iii) Criterion 3 - Limiting the Effects of Solar Gains in Summer

It is a requirement to demonstrate that solar gains have been limited during the summer period to either reduce the need for air conditioning; or to reduce the installed capacity of any air conditioning system that is installed.

To demonstrate compliance with criterion 3 an assessment of the solar gains must be undertaken, the actual building results are then compared to a pre-defined standard and if the performance of the actual building is no worse than that of the pre-defined building then it is deemed to comply with the criterion.

(iv) Criterion 4 – Building Performance Consistent with BER

The process for demonstrating compliance with criterion 4 is generally the same as criterion 1, the difference is that the actual building performance is compared to the notional building, for example, the air permeability results, building services commissioning figures, achieved construction u-values are used rather than the design assumptions.

It then must be demonstrated that the actual building performance is equal to or better than the TER.

Notice should be given that commissioning has been carried out according to a procedure approved by the Secretary of State.

(v) Criterion 5 – Provisions for Energy-Efficient Operation of the Building

The owner of the building should be provided with sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

This is generally achieved by production of a building logbook.

2.5.1 The Introduction of SAP 10

The new methodology under Part L 2021 has several aspects that make Part L more stringent to achieve in general, however one major change is the Fuel Carbon Factors for each of the fuel applied within the calculation for energy generation. The change is specific to the grid electricity, this fuel factor is to be lowered to fall in line with gas.

This change makes an all-electric heating and hot water system in line with a gas system in terms of efficiency, therefore gas and CHP systems will have less of a benefit within the new calculations. This coupled with the benefits of removing gas from certain sites has huge advantages for developments such as this.

This change in the fuel factor is a direct result of the “greening of the grid” which has occurred due to the current proportion (circa 48%) of grid energy now coming from renewable sources, primarily offshore wind, solar PV and Biomass generators. There is a focus on the use of all electric heating and hot water systems within our recommendation to take advantage of the new fuel factors coming out in SAP 10 and support the policies of the Manchester Core Strategy by using an all-electric system supplied by grid electricity which will eventually become a zero-carbon energy source.

2.5.2 RIBA 2030 Climate Challenge

In addition to the upcoming fuel carbon factors this Energy Strategy has also given consideration to the RIBA 2030 Climate Challenge.

The RIBA 2030 Climate Challenge sets out a number of Sustainable Outcome targets including:

- Operational Energy
- Embodied Carbon
- Potable Water Use

It also sets out a number of best practice Health Targets including:

- Overheating
- Daylighting
- CO₂ Levels
- Total VOC's (Volatile Organic Compounds)
- Formaldehyde

The RIBA 2030 Climate Challenge was created following the RIBA Council vote on 29th June 2019 to join the global declaration of an environmental and climate emergency. These targets are none binding and still under development as RIBA discusses these metrics further with industry bodies before the targets are finalised. They do however make a useful resource for best practice given that these targets were developed to address the current climate emergency, therefore, although the targets are non-binding they have been considered where appropriate.

Figure 7: RIBA 2030 Climate Challenge Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	146 kWh/m ² /y (Ofgem benchmark)	< 105 kWh/m ² /y	< 70 kWh/m ² /y	< 0 to 35 kWh/m ² /y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1000 kgCO ₂ e/m ² (M4i benchmark)	< 600 kgCO ₂ e/m ²	< 450 kgCO ₂ e/m ²	< 300 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

RIBA 2030 Climate Challenge target metrics for non-domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	225 kWh/m ² /y DEC D rated (CIBSE TM46 benchmark)	< 170 kWh/m ² /y DEC C rating	< 110 kWh/m ² /y DEC B rating	< 0 to 55 kWh/m ² /y DEC A rating	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1100 kgCO ₂ e/m ² (M4i benchmark)	< 800 kgCO ₂ e/m ²	< 650 kgCO ₂ e/m ²	< 500 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	>16 l/p/day (CIRA W11 benchmark)	< 16 l/p/day	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G

Above is an extract showing the target metrics for domestic and non-domestic buildings. Particularly relevant to this report are the “Operational Energy” and “Potable Water Use” targets as through a fabric first approach, low/zero carbon technology and use of renewables these issues have been considered.

The Embodied Carbon target is addressed as far as our capacity as the Sustainability Consultant is concerned however in order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of each block, particularly parties with ISO14001 accreditation.

We have endeavoured to achieve the targets outlined through the fabric first approach combined with Low Carbon technology and efficient fittings all of which are detailed further in this report.

3 DESIGN PARAMETERS

3.1 METHODOLOGY

The Standard Assessment Procedure (SAP) is the Government's approved methodology for assessing the predicted energy consumption and carbon dioxide emissions for new domestic developments. SBEM is the Simplified Building Energy Model which is the methodology for assessing non-domestic developments.

Results are derived in respect of floor area and consider energy use (kWh/m²/yr) and associated CO₂ emissions (kg.CO₂/m²/yr) from the following:

- Space heating
- Domestic hot water
- Ventilation
- Lighting
- Ancillary pumps and fans
- Energy generation technology

SAP/SBEM is compliant with the EU Energy Performance of Buildings Directive and is carried out using approved software. For the purpose of this report, data has been produced by an Accredited Energy Assessor using FSAP and IES software to produce the data for this report.

To enable a review of each level of the Energy Hierarchy, firstly the Baseline CO₂ emission figures must be established. These figures are based on Part L1A/L2A 2013's 'Notional Building', a specific set of specification criteria referenced in section 3.4 of this report.

All additional measures included to reduce the overall CO₂ emissions such as improved building fabric and low carbon technology will be compared against the Baseline figures. These figures are the Target Emission Rate derived from the SAP assessment and resulting Design Stage SAPs.

A 'fabric first' approach will be undertaken throughout this report, looking at improvements to the thermal envelope initially to understand the improvements that can be gained prior to the feasibility of any renewable / low carbon technologies.

Renewable / low carbon technologies will then be considered with regards to special constraints, feasibility, and appropriateness in relation to the site.

NOVO Integration Ltd have used the following information to formulate the Energy Strategy.

3.2 ARCHITECTURAL DRAWINGS BY HODDERS AND PARTNERS

Table 5 Architects Drawing Schedule

The following drawings have been used to produce the Energy Model.

Drawing Number	Drawing Contents
0643-HOD-ZZ-00-DR-A-20200	Level 00 Plan
0643-HOD-ZZ-00-DR-A-20201	Level 01 Plan
0643-HOD-ZZ-00-DR-A-20202	Level 02-05 Plan
0643-HOD-ZZ-00-DR-A-20206	Level 06 Plan
0643-HOD-ZZ-00-DR-A-20207	Level 07 Plan
0643-HOD-ZZ-00-DR-A-20208	Level 08-14 Plan
0643-HOD-ZZ-00-DR-A-20215	Level 15 Plan
0643-HOD-ZZ-00-DR-A-20216	Level 16 Plan
0643-HOD-ZZ-00-DR-A-20217	Level 17 Plan
0643-HOD-ZZ-00-DR-A-20218	Level 18 – 25 Plan
0643-HOD-ZZ-00-DR-A-20226	Level 26 – 36 Plan
0643-HOD-ZZ-00-DR-A-20237	Level 37 – 40 Plan
0643-HOD-ZZ-00-DR-A-20241	Level 41 Plan
0643-HOD-ZZ-00-DR-A-20242	Level 41M Mezzanine Plan
0643-HOD-ZZ-00-DR-A-20243	Roof Plan
0643-HOD-ZZ-00-DR-A-20244	Level B1 Plan
0643-HOD-ZZ-00-DR-A-20245	Level B2 Plan
0643-HOD-ZZ-00-DR-A-20246	Level B3 Plan
0643-HOD-ZZ-00-DR-A-20300	North Elevation
0643-HOD-ZZ-00-DR-A-20301	East Elevation
0643-HOD-ZZ-00-DR-A-20302	South Elevation
0643-HOD-ZZ-00-DR-A-20303	West Elevation
0643-HOD-ZZ-00-DR-A-20304	North Elevation Podium
0643-HOD-ZZ-00-DR-A-20305	East Elevation Podium
0643-HOD-ZZ-00-DR-A-20306	South Elevation Podium
0643-HOD-ZZ-00-DR-A-20307	West Elevation Podium
0643-HOD-ZZ-00-DR-A-20400	Section AA
0643-HOD-ZZ-00-DR-A-20401	Section BB

3.3 FUEL

Table 6 Fuel Factors SAP 2012 and SAP 10

kgCO₂/kWh	SAP 2012	SAP 10.1
Gas:		
mains gas	0.216	0.210
bulk LPG	0.241	0.241
bottled LPG	0.241	0.241
bottled LPG (no contract)	0.241	0.241
LPG subject to Special Condition 18	0.241	0.241
biogas (including anaerobic digestion)	0.098	0.024
Liquid fuel:		
heating oil	0.298	0.298
biodiesel from any biomass source	0.123	0.038
biodiesel from vegetable oil only	0.083	0.018
appliances able to use mineral oil or biodiesel	0.298	0.298
B30K	0.245	0.220
bioethanol from any biomass source	0.140	0.105
Solid fuel:		
house coal	0.394	0.395
anthracite	0.394	0.395
manufactured smokeless fuel	0.433	0.366
wood logs	0.019	0.028
wood pellets (in bags for secondary heating)	0.039	0.053
wood pellets (bulk supply for main heating)	0.039	0.053
wood chips	0.016	0.023
dual fuel appliance (mineral and wood)	0.226	0.087
Electricity:		
standard tariff	0.519	0.136
7-hour tariff (high rate)	0.519	0.136
7-hour tariff (low rate)	0.519	0.136
10-hour (high rate)	0.519	0.136
10-hour (low rate)	0.519	0.136
18-hour (high rate)	0.519	0.136
18-hour (low rate)	0.519	0.136
24-hour heating tariff	0.519	0.136
electricity exported to grid	0.519	0.136
electricity, any tariff	0.519	0.136
Community heating schemes:		
heat from boilers - mains gas	0.216	0.210
heat from boilers - LPG	0.241	0.241
heat from boilers - oil	0.331	0.335
heat from boilers that can use mineral oil or biodiesel	0.331	0.335
heat from boilers using biodiesel from any biomass source	0.123	0.038
heat from boilers using biodiesel from vegetable oil only	0.083	0.018
heat from boilers - B30D	0.269	0.269
heat from boilers - coal	0.380	0.375
heat from electric heat pump	0.519	0.136
heat from boilers - waste combustion	0.047	0.074
heat from boilers - biomass	0.031	0.029
heat from boilers - biogas (landfill or sewage gas)	0.098	0.024
waste heat from power station	0.058	0.015
geothermal heat source	0.041	0.011
heat from CHP	as above	0.011
electricity generated by CHP	0.519	0.136
electricity for pumping in distribution network	0.519	0.136

The above table summarises the emission factors for all fuel types, this is provided in the latest BRE Technical Paper on CO₂ and Primary Energy Factors for SAP. As you can see the SAP 10 fuel factor for grid electricity is vastly improved over the 2012 version, hence the SAP 10 software has been used to produce the results shown later in this report.

3.4 BASELINE CO₂ EMISSIONS

For the purpose of this report the baseline energy use and CO₂ emissions are calculated based on the 'Notional Dwelling' requirements specified in the Building Regulations L1A 2013 (Table 5).

Table 7 Residential Baseline Building Fabric

Element	Part L1A: 2013 Limiting u values (W/m ² .k)	Part L1A: 2013 Notional u-values (W/m ² .k)
Floors	0.25	0.13
External Walls	0.30	0.18
Party Wall between dwelling	0.20	0.00
Roof	0.20	0.13
Windows	2.0	1.40
Doors	2.0	1.00
Y-value (W/m ² .k)	0.15	~0.05
Air permeability (m ³ /h.m ² @ 50 pa)		
All dwellings	10.0	5.0

Table 8 Non-Domestic Baseline Building Fabric

Element	Part L2A: 2013 Limiting u values (W/m ² .k)	Part L2A: 2013 Notional u-values (W/m ² .k)
Floors	0.25	0.22
External Walls	0.35	0.25
Roof	0.25	0.18
Windows	2.2	1.60
External Doors	2.2	2.2
Air permeability (m ³ /h.m ² @ 50 pa)		
Commercial space	10.0	5.0

In addition to the limiting and notional u-values Part L2A has its own baseline System inputs. Please see Figure 7 below which is a full notional dwelling specification.

Figure 7 Part L2A Notional Specification including systems

Table 5 Summary of concurrent notional building specification			
Element	Side lit or unlit (where HVAC specification is heating only)	Side lit or unlit (where HVAC specification includes cooling)	Top lit
Roof U-value (W/(m ² .K))	0.18	0.18	0.18
Wall U-value (W/(m ² .K))	0.26	0.26	0.26
Floor U-value (W/(m ² .K))	0.22	0.22	0.22
Window U-value (W/(m ² .K))	1.6 (10% FF)	1.6 (10% FF)	N/A
G-value (%)	40	40	N/A
Light transmittance (%)	71	71	N/A
Roof-light U-value (W/(m ² .K))	N/A	N/A	1.8 (15% FF)
G-value (%)	N/A	N/A	55
Light transmittance (%)	N/A	N/A	60
Air permeability (m ³ /(m ² .hour))	5	5	7
Gross internal area less than or equal to 250 m ²			
Air permeability (m ³ /(m ² .hour))	3	3	7
Gross internal area greater than 250 m ² and less than 3500 m ²			
Air permeability (m ³ /(m ² .hour))	3	3	5
Gross internal area greater than or equal to 3500 m ² and less than 10,000 m ²			
Air permeability (m ³ /(m ² .hour))	3	3	3
Gross internal area greater than or equal to 10,000 m ²			
Lighting luminaire (lm/circuit watt)	60	60	60
Occupancy control (Yes/No)	Yes	Yes	Yes
Daylight control (Yes/No)	Yes	Yes	Yes
Maintenance factor	0.8	0.8	0.8
Constant illuminance control	No	No	No
Heating efficiency (heating and hot water) (%)	91	91	91
Central ventilation SFP (W/(l.s))	1.8	1.8	1.8
Terminal unit SFP (W/(l.s))	0.3	0.3	0.3
Cooling (air-conditioned) (SEER/SSEER)	N/A	4.5 / 3.6	4.5 / 3.6
Cooling (mixed mode) (SSEER) ¹	N/A	2.7	2.7
Heat recovery efficiency (%)	70	70	70
Variable speed control of fans and pumps, controlled via multiple sensors	Yes	Yes	Yes
Demand control (mechanical ventilation only). Variable speed control of fans via CO ₂ sensors	Yes	Yes	Yes
Note 1: Mixed mode assumed to be cooled by DX unit where SSEER includes indoor and outdoor units and fans, pumps and losses			

By using low u-values and high-performance materials to reduce greenhouse emissions, the Be Lean stage of this report is in accordance with Paragraph 150 of the National Planning Policy Framework (NPPF). Furthermore, the use of low u-values in conjunction with accredited details demonstrates an effort to reach the Operational Energy and CO₂ emission targets of the RIBA 2030 Climate Challenge.

The following table details the notional baseline area weighted CO₂ regulated emissions for the development. The target emission rates (TER's) in the above figures combined with the total floor area was used to produce the baseline CO₂ emissions below.

Table 9 Estimated Baseline Carbon Emissions 2012 Building Regulations

Building Services	Baseline CO₂ Emissions (kg CO₂/m²/yr)	Baseline CO₂ Emissions for overall development (kg CO₂/ yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	25.12	1,163,460

Table 10 Estimated Baseline Carbon Emissions 2021 Building Regulations

Building Services	Baseline CO₂ Emissions (kg CO₂/m²/yr)	Baseline CO₂ Emissions for overall development (kg CO₂/ yr)
Total regulated emissions (heating, hot water, lighting, fans & pumps)	8.67	378,720.4

By using low u-values and high-performance materials to reduce greenhouse emissions and improve energy efficiency; the Be Lean stage of this report addresses policies EN4 and EN6 of the Manchester Core Strategy and is in accordance with Paragraph 8 of the National Planning Policy Framework (NPPF) by reducing CO₂ emissions and supporting a low carbon economy.

Section 4 below will now detail how the reduction between the dwelling emission rate (DER) and the target emission rate (TER) has been achieved.

4 ENERGY STRATEGY

4.1 ENERGY EFFICIENT DESIGN

This section outlines the design energy efficient measures taken to minimise the building's energy demand and therefore reduce energy use and CO₂ emissions further than the baseline notional building, often referred to as the 'Fabric First' approach.

The energy efficient measures include:

- a) Inclusion of better U-values than the minimum U-values set in the ADL1A
- b) Designing for a buildings air permeability exceeding ADL1A target values
- c) Utilising the highly efficient heating and hot water systems
- d) Utilising low energy efficient lighting such as LED lighting

The table below outlines the improvements made to the building fabric elements compared against both the Building Regulations limiting U-values and the 'Notional Dwelling' U-values which the baseline is derived from.

Table 11 Proposed Building Fabric Specification

Building Fabric			
Element	L1A: 2013 Limiting U-values (W/m ² .k)	L1A: 2013 Notional U-values (W/m ² .k)	Proposed U-values (W/m ² .k)
Floors	0.25	0.13	0.18
External Walls	0.30	0.18	0.24
Party walls between dwelling	0.20	0.00	0.00
Roof	0.20	0.13	0.15
Windows	2.00	1.40	1.1 (g-value 0.4)
Doors	2.00	1.0	N/A
Y – value (W/m ² .k)	0.15	~0.05	~0.07 – 0.12
Air permeability (m ² /h.m ² @ 50 pa)			
All dwellings	10.0	5.0	5.0

The above table shows that all fabric elements are improved over the limiting values, the fabric strategy has focussed on improving the glazing element as this element forms a large part of the overall fabric. Focussing the fabric efficient design here is therefore an effective method of maintaining the fabric first ethos.

4.1.1 Heating Demand

The heating energy demand will be reduced by providing high performance insulation of the building envelope as well as a low Air Permeability Target to minimise heat losses. Thermal Bridging will also be reduced through insulation to all relevant junctions to achieve Psi values associated with accredited construction details (for all PSI values refer to Table 1 in this report).

For the domestic aspect of the development, low carbon Air Source Heat Pumps have been chosen to provide heating and cooling to the apartments. This will be supplemented by mechanical ventilation with heat recovery that will reuse waste heat to lower the energy demand of the main heating system. Hot water will be provided by a dual electric immersion cylinder which has a 100% delivery efficiency.

The non-domestic aspect will largely follow the general strategy of the apartments using both ASHP's and MVHR for heating and ventilation. Circulation/WC areas will be serviced by electric panel heaters which also have a 100% delivery efficiency. Hot water will be provided by a QAHV ASHP in the case of non-domestic areas with some instances of electric water heaters.

As this strategy effectively reduces the reliance on fossil fuels and contributes to the overall CO₂ reduction of the development, it therefore addresses Policy EN6 of the Manchester Core Strategy whilst also adhering to paragraph 150 of the National Planning Policy Framework (NPPF).

4.1.2 Ventilation

The development will take advantage of a Mechanical Ventilation Heat Recovery (MVHR) system.

Occupants will also have a natural ventilation option via the openable balcony doors where applicable. Extract fans will be included to all wet areas and in the kitchens.

MVHR is, in its simplest form is a heat exchanger. The system extracts warm stale air from within the Building, at the same time drawing in cooler fresh air from outside. These are then ducted into the actual MVHR unit itself, at which point the heat is exchanged without mixing the air, therefore fresh, warm air is vented into the building.

This system recovers heat from within the units which otherwise would be lost, therefore reducing the amount of energy required to maintain temperature within the units.

4.1.3 Lighting

The proposed light fittings will be low energy efficient fittings, in this instance LED fittings only throughout.

4.1.4 Embodied Carbon

All materials used within the construction of the development will have embodied carbon within them, taking into consideration manufacturing processes and supply chains. It is assumed that the developer will seek to procure materials and construction elements with appropriate sustainable accreditations, for example FSC for timber, ISO:140001 accreditations where applicable etc, to minimise the use of high embodied carbon within the building.

4.2 CO₂ REDUCTIONS AFTER FABRIC FIRST APPROACH

The following table demonstrates the reduction in CO₂ emissions based on an area weighted average calculation utilising a fabric first approach with no reduction incorporated from the inclusion of any renewable / low carbon technology:

Figure 12: Fabric First Results SAP 2012

Regulated Emissions	Baseline CO ₂ Emissions	Fabric First Building CO ₂ Emissions	CO ₂ Emission Savings	% Reduction in CO ₂ Emissions
kg of CO ₂ /m ² /yr	26.66	25.12	1.54	5.79%
kg of CO ₂ /yr	1,163,460	1,096,088.1	67,371.9	

Figure 13: Fabric First Results SAP 10

Regulated Emissions	Baseline CO ₂ Emissions	Fabric First Building CO ₂ Emissions	CO ₂ Emission Savings	% Reduction in CO ₂ Emissions
kg of CO ₂ /m ² /yr	8.67	6.74	1.93	22.28%
kg of CO ₂ /yr	378,720.4	294,356.19	84,364.21	

From the figures above, the overall CO₂ reduction complies with SAP 2012 and through the SAP 10 Part L 2021 calculation, the required 9% reduction in CO₂ has been exceeded. This is due to the more up to date and accurate fuel factors applied to grid electricity.

The Dwelling Fabric Energy Efficiency (DFEE) results also show an improvement over the baseline this shows that the fabric first approach is at the forefront of this strategy and is therefore not overly reliant on updated fuel carbon factors or highly efficient Mechanical systems.

- Target Fabric Energy Efficiency 39.15 kWh/m²/yr.
- Dwelling Fabric Energy Efficiency 34.85 kWh/m²/yr.
- Reduction % = 10.98%

Figure 10: Fabric First Carbon Emissions SAP 2012 Results

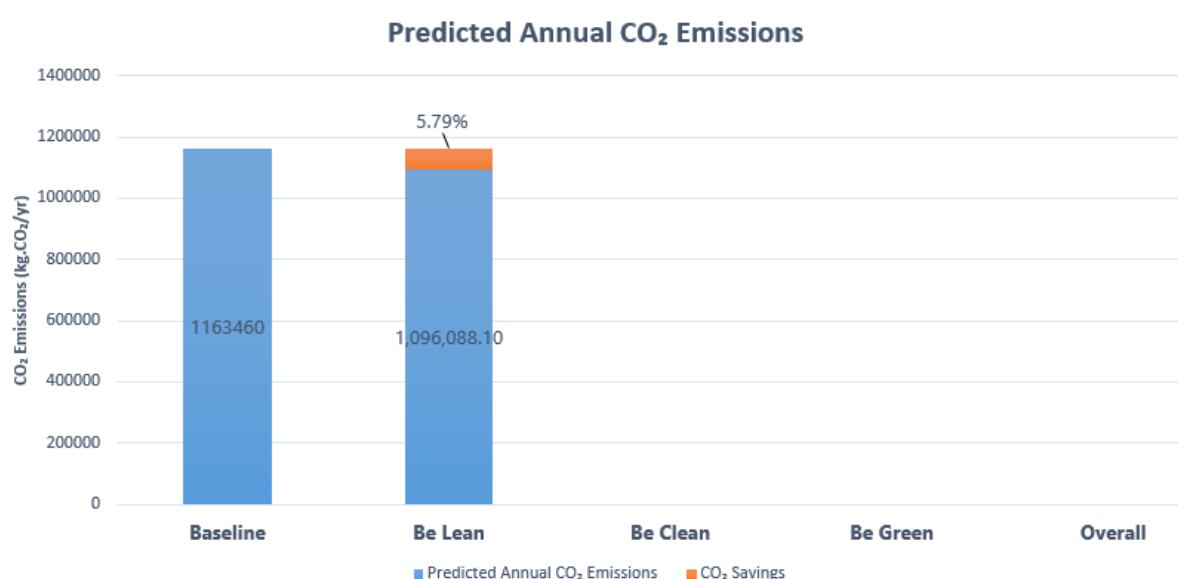
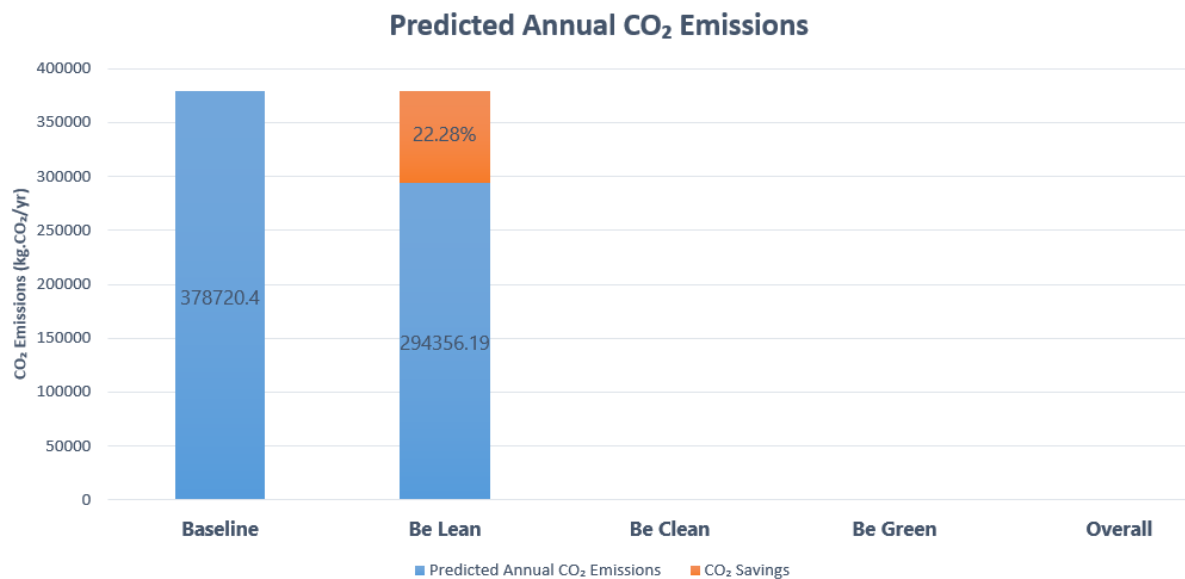


Figure 11: Fabric First Carbon Emissions Estimated SAP 10 Results



4.3 CLEANER ENERGY - CHP & DECENTRALISED ENERGY NETWORKS

The Energy Hierarchy encourages the use of a CHP system and/or the connection to District Heating system to reduce CO₂ emissions further.

4.3.1 CHP

The Energy Hierarchy identifies combined heat and power (CHP) as a method of producing heat and electricity with much lower emissions than separate heat and power. Also, it encourages the creation of district heating systems supplied by CHP.

The implementation of a CHP strategy should be decided according to good practice design. Key factors for the efficient implementation of the CHP system are:

- Development with high heating load for the majority of the year
- CHP operation based on maximum heat load for minimum 10 hours per day
- CHP operation at maximum capacity of 90% of its operating period

A CHP system will not be considered for this development due to the following reasons:

- Due to restrictions on site space would be limited for the level of plant required for a CHP system, which would require accumulators, additional boiler power, pumps, pressurisation units etc.
- Pollution discharged from the CHP unit may not be appropriate given the site locality and the number of people passing the site given its location within a residential area.
- Noise pollution is a consideration given the function of the development and its proximity to other surrounding buildings.
- Economic viability is heavily dependent on the constant demand for heat and power, as well as the price of electricity and gas.

- An all-electric system has been used in this strategy to take advantage of upcoming fuel factors for grid electricity and provide some level of future proofing as grid electricity closes in on carbon neutrality over time.

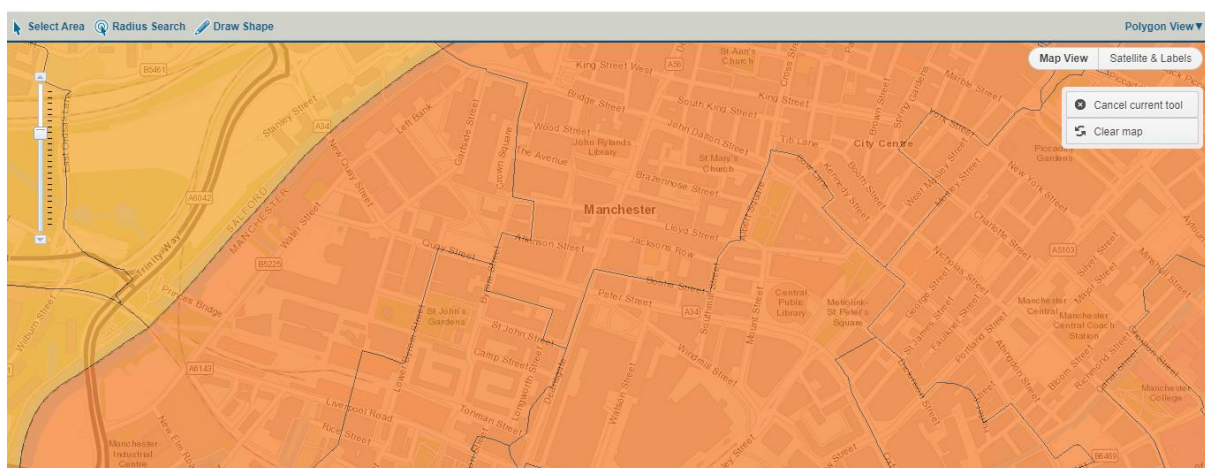
Hence, the implementation of a CHP strategy is not recommended for this development.

As a result, no CO₂ reduction can be achieved as part of the Be Clean section of the Energy Hierarchy.

4.3.2 Decentralised Energy Network

The feasibility of connecting into an existing heating network or providing the building with its own combined heat and power plant has been assessed through the use of UK CHP Development Map, for Manchester as for a District Heating network.

Figure 12: CHP Development Map – Local Heat Loads



Presently there is the potential to connect to a heat network and should the District Heating Network evolve into an all-electric system and the infrastructure for such be provided then connection could be considered in the future.

Heat networks are best suited to large developments with appropriate plant space for buffer vessel, plate heat exchangers and manifold positions, meters, furthermore the pipework required for connection to each unit makes this option financially unviable.

An all-electric strategy is the preferred option as the fuel carbon factor for grid electricity is to be brought in line with natural gas and will eventually become zero carbon as the portion of renewable energy supplied to the grid increases. This therefore provides the development with some future proofing, better addresses the current climate emergency by removing another potential source of emissions and supports the RIBA 2030 Climate Challenge through a low carbon heating and hot water solution.

As such no additional CO₂ reduction can be observed at the Be Clean stage, this is described in the graph below:

Figure 13: Be Clean Carbon Emissions SAP 2012 Result

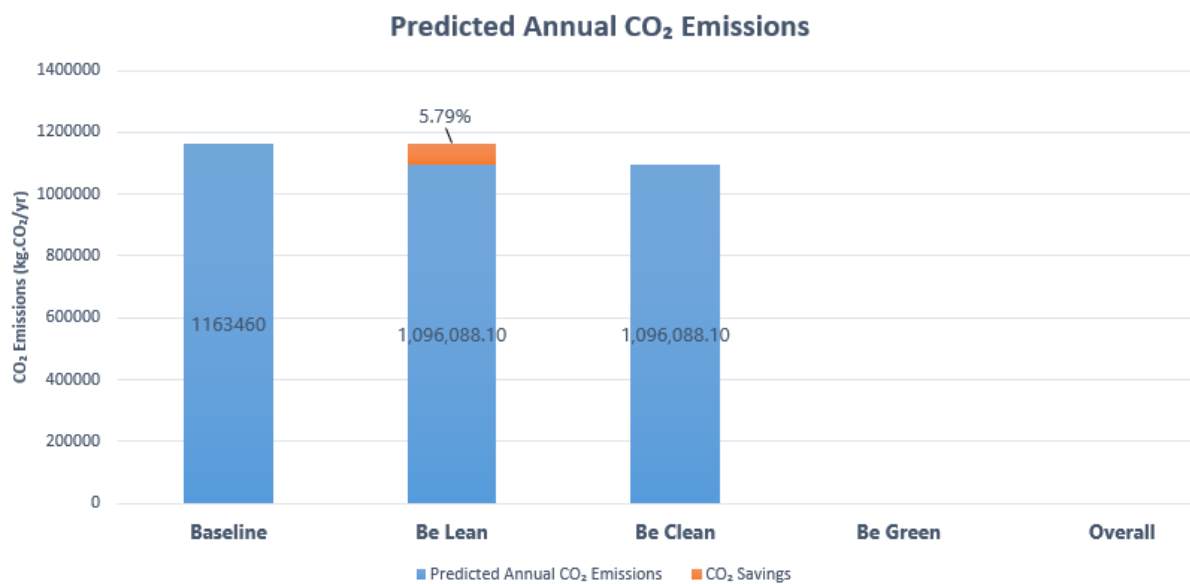
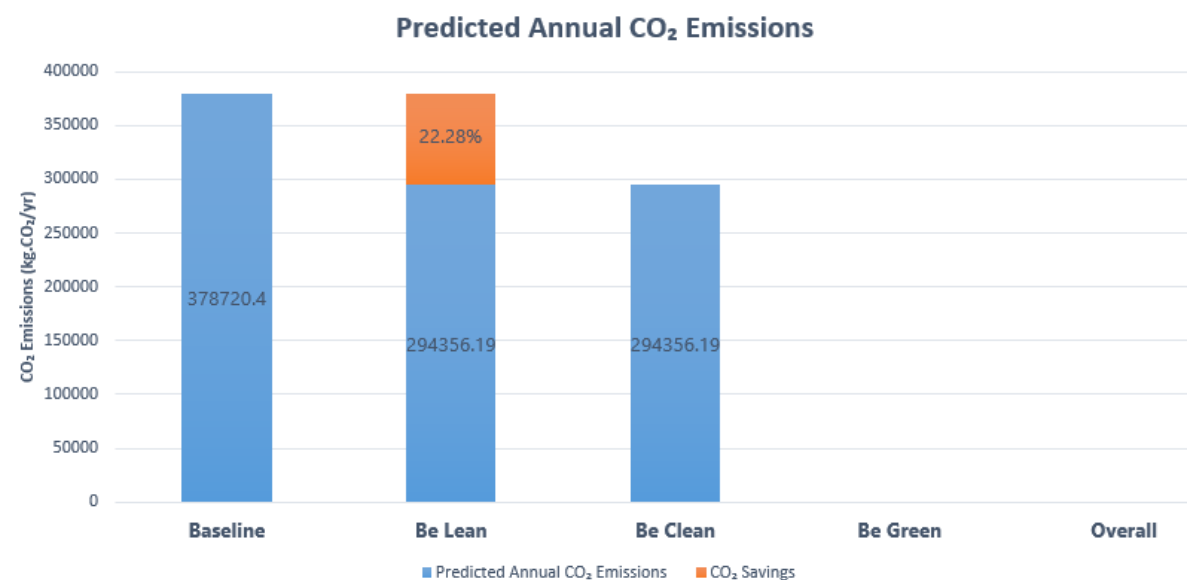


Figure 14: Be Clean Carbon Emissions Estimated SAP 10 Result



4.4 LOW & ZERO CARBON TECHNOLOGIES

4.4.1 General

Low and zero carbon (LZC) technologies are systems that generate energy with either zero or reduced CO₂ emissions when compared against traditional energy generation methods.

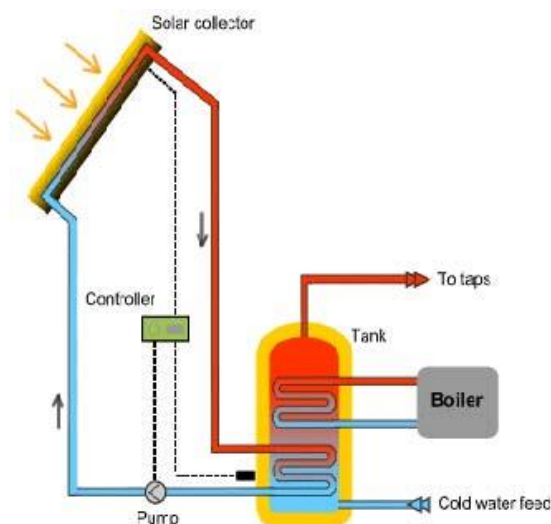
The alternative LZC technologies have been assessed in relation to the development and their viability assessed. Some of the LZCs are intrinsically unsuitable due to the development type and location whereas others are potentially viable.

4.4.2 Solar Water Heating

Solar thermal panels utilise the sun energy to generate hot water for use within the building. The panels are commonly provided in either flat plate or evacuated tube arrangements. The panels are ideally located facing south at an approximate 30° inclination angle in areas where they are not subjected to shade.

This system alone would not generate a large enough CO₂ reduction in proportion to other comparable technologies. This technology has also been discounted due to the inflated cost of installation with regards additional pipe runs, maintenance requirements and the significant roof area that would be required.

Figure 15: Solar Thermal Diagram



4.4.3 Wind Turbines

Wind turbines generate electrical energy derived from kinetic energy provided by the local wind resource. The performance of wind turbines depends greatly on the wind speed and turbulence that in turn is influenced by the terrain and installation height.

Figure 16: Typical Small Scale 6kW Wind Turbine



The use of wind turbines on the development will also have a significant visual impact on the city centre location and neighbouring buildings, as well as low frequency noise source and hence it is likely to meet opposition within the local area.

In very simplistic terms, space for such a large technology on this development site cannot be considered.

For the reasons detailed above wind turbines are not considered viable for the development.

4.4.4 Photovoltaic Cells (PV)

Photovoltaic (PV) panels utilise the sun's energy to generate electricity. The optimum location for PV panels is south facing at an approximate 30-45° inclination angle in areas where they are not subjected to shade.

Figure 17: PV Examples



PV technology has been discounted from this strategy due to limited roof space for installation, furthermore there is limited plant space to accommodate inverters. The requirements of Part L and the Manchester Core Strategy can be met through fabric efficiency and low carbon M&E design, PV is

therefore not required on this development and would be impractical to install given the nature of building as a tower block with limited roof area.

4.4.5 Source Heating and Cooling

The Air Source Heat Pumps can be linked with indoor units to heat and cool the space. These could be either ceiling mounted cassette units, wall mounted units or floor mounted units. This option therefore has good flexibility in terms of installation. The outdoor units can be located anywhere and are not dependant on orientation. They need to be externally mounted and in a local compound to be safe.

ASHP technology has been included within the design to provide heating and cooling to domestic and non-domestic areas. This technology will also service part of the non-domestic hot water demand. ASHP's benefit from a simple installation process and low maintenance. Furthermore, they are very efficient with respect to energy produced vs energy used, for every 3-4 units of energy produced only 1 unit of energy is used. This technology has been chosen for its excellent carbon performance which best addresses the requirements of Part L, the Manchester Core Strategy, and the RIBA 2030 Climate Challenge.

4.4.6 Biomass Boiler

Biomass is considered to be a renewable fuel source as the CO₂ absorbed during the growth period is assessed as being approximately equal to the CO₂ emitted during combustion and hence deemed "carbon neutral". Biomass for boilers is typically wood either in chip or pellet form.

Biomass boilers require fuel storage together with associated transportation and delivery to the store location.

Figure 18: Biomass Example



With the minimal plant areas available for a biomass generator combined with the logistics and increase in pollution from wood pellet deliveries/transportation, biomass generators have not been included in this Energy Strategy.

For the above reasons, the use of a biomass boiler plant is not considered viable for the development.

4.4.7 Fuel Cell

The fuel cell technology essentially converts chemical energy into both electrical and heat energy. The cell needs to be continually supplied with hydrogen (derived from either a piped or storage source) and oxygen (derived from air) that are combined and the chemical reaction produce electrical energy, heat energy and water vapour.

The fuel cell requires a hydrogen fuel source that can either be from a piped source (not currently available) or from stored gas. However, the more usual approach currently in the UK is to use natural gas in order to generate the hydrogen required to operate the fuel cell.

Fuel cells have various commercial and technical limitations. There is a high initial capital cost together with there being few established suppliers and a very limited specialist design, installation, and maintenance capabilities.

Certain fuel cell elements require regular replacement imposing a significant on-going cost implication. The fuel cells themselves are generally large, heavy and require fresh air ventilation.

Due to the initial capital cost, space requirements and on-going maintenance costs fuel cells are not considered viable for this development.

4.5 WATER

The development will be designed to reduce mains/potable water and include water efficient devices and equipment. This will comprise of efficient water fixtures (low flow taps and showers, dual flush WCs and low volume baths) to reduce potable water demand to < 16 litres/person/day as per the requirement within Building Regulations.

As stated previously < 16 litres/person/day is the 2020 target in the RIBA 2030 Climate Challenge and the next target 2025 is < 13 litres/person/day, this surpasses the requirement of Part G and we will use our best endeavour to reach this target.

This will be done using low flow rate sanitaryware and the use of flow restrictors throughout the development.

An example of the flow rates and capacities that could potentially be used are as follows. Please note these are a guide at this stage and actual figures may differ at the time of construction. However, they will fall within the required level:

- WC – Dual Flush – 6/3 Litre Flush capacity
- Wash hand basin taps – 5 L/min
- Kitchen sink taps – 7L/min
- Shower – 7L/min

4.6 CHOSEN RENEWABLE SOLUTION

Following the above review of various LZC technology the chosen solution for this strategy is to utilise low carbon air source heat pumps to provide heating and cooling. This would be used in conjunction with the fabric efficiency improvements as described at the Be Lean stage which; at present can satisfy the required CO₂ reduction stated in the current Manchester Core Strategy 2012 without the inclusion of any additional renewable technology.

As such no additional CO₂ reduction can be observed at the Be Green stage.

Figure 19: Be Green Carbon Emissions SAP 2012 Results

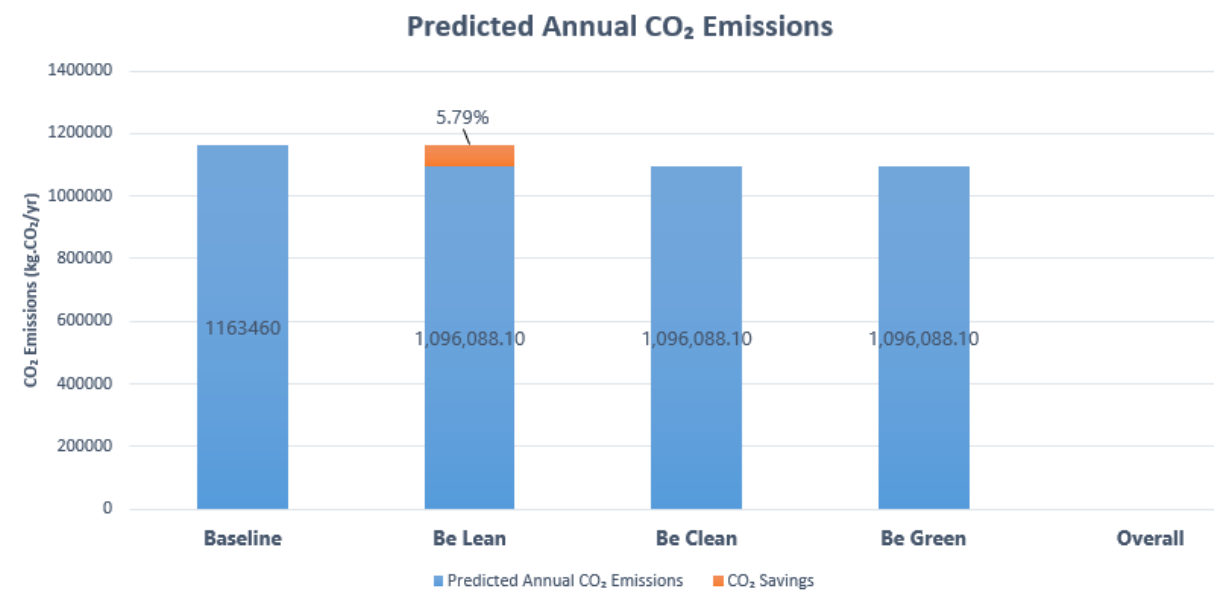
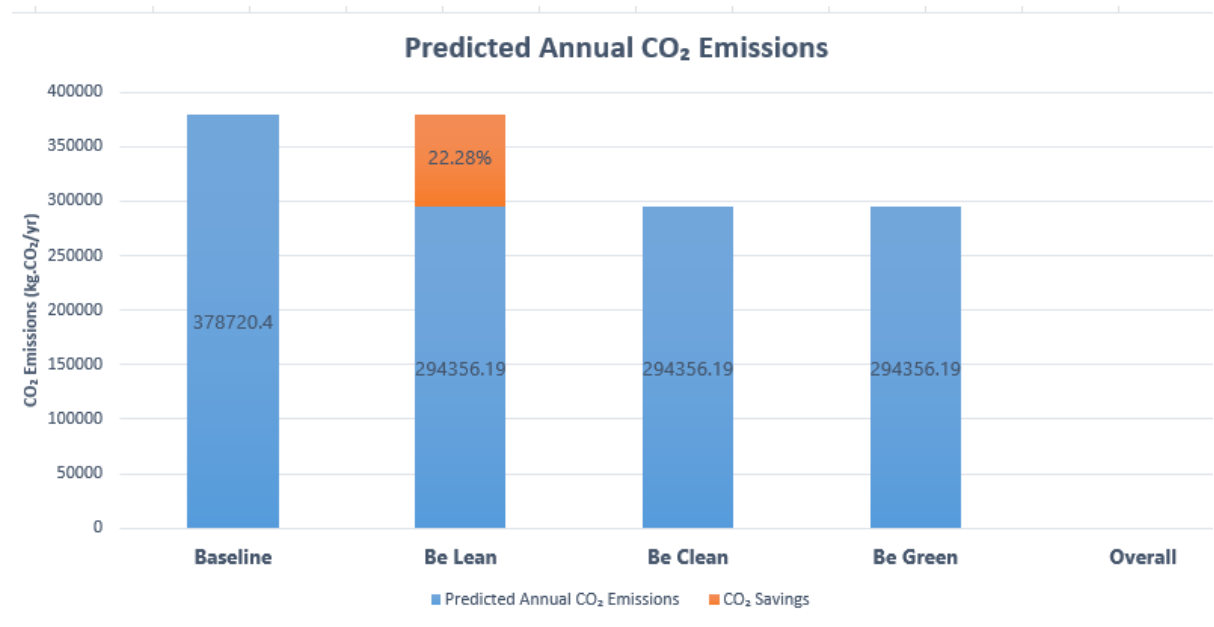


Figure 20: Be Green Carbon Emissions Estimated SAP 10 Results



4.7 PRIMARY ENERGY DEMAND & RIBA 2030 CLIMATE CHALLENGE

In order to calculate the energy demand for the entire development in kWh/yr the following is required.

The energy demand is made up of the following factors:

- Energy for space heating
- Energy for space cooling
- Energy for water heating
- Energy for ventilation
- Energy for lighting
- Energy generated by renewables

This is more specifically the Primary, Regulated Energy Demand given the fabric, considering the above factors.

The estimated SAP 10 primary energy demand results are displayed in the below table for typical units.

Table 14 Primary Energy Demand Typical Units

Unit	Energy Demand kWh/m ² /yr
Typical 1 bed unit Level 18	67.79 kWh/m ² /yr
Typical 2 bed unit Level 18	67.92 kWh/m ² /yr
Typical 2 bed unit Level 26	59.21 kWh/m ² /yr
Typical 2 bed unit Level 37	49.61 kWh/m ² /yr
Typical 3 bed unit Level 37	35.33 kWh/m ² /yr
Duplex Level 43	50.21 kWh/m ² /yr

This is a decent improvement on the current benchmark target of 105 kWh/m²/yr and achieves the current RIBA 2030 Climate Challenge 2025 Target of < 70 kWh/m²/yr. It is worthy of note however that RIBA intend to work with professional bodies to finalise their target metrics which may change as those discussions progress.

Figure 21: RIBA 2030 Climate Challenge Domestic Target Metrics

RIBA 2030 Climate Challenge target metrics for domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y	146 kWh/m ² /y (Ofgem benchmark)	< 105 kWh/m ² /y	< 70 kWh/m ² /y	< 0 to 35 kWh/m ² /y	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ²	1000 kgCO ₂ e/m ² (M4i benchmark)	< 600 kgCO ₂ e/m ²	< 450 kgCO ₂ e/m ²	< 300 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day	125 l/p/day (Building Regulations England and Wales)	< 110 l/p/day	< 95 l/p/day	< 75 l/p/day	CIBSE Guide G

The Part L1A CO₂ reduction results also contribute to the embodied carbon targets with a 22.28% reduction in kg CO₂/m² being achieved through the use of fabric improvements alone as per the Be Lean stage of this report.

The non-domestic Operational Energy demand currently stands at around 82.48 kWh/m²/yr which also achieves the 2025 target shown in the figure below.

Figure 22: RIBA 2030 Climate Challenge Non-Domestic Target Metrics

RIBA 2030 Climate Challenge target metrics for non-domestic buildings

RIBA Sustainable Outcome Metrics	Current Benchmarks	2020 Targets	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m ² /y 	225 kWh/m ² /y DEC D rated (CIBSE TM46 benchmark)	< 170 kWh/m ² /y DEC C rating	< 110 kWh/m ² /y DEC B rating	< 0 to 55 kWh/m ² /y DEC A rating	UKGBC Net Zero Framework 1. Fabric First 2. Efficient services, and low-carbon heat 3. Maximise onsite renewables 4. Minimum offsetting using UK schemes (CCC)
Embodied Carbon kgCO ₂ e/m ² 	1100 kgCO ₂ e/m ² (M4i benchmark)	< 800 kgCO ₂ e/m ²	< 650 kgCO ₂ e/m ²	< 500 kgCO ₂ e/m ²	RICS Whole Life Carbon (A-C) 1. Whole Life Carbon Analysis 2. Using circular economy Strategies 3. Minimum offsetting using UK schemes (CCC)
Potable Water Use Litres/person/day 	>16 l/p/day (CIRA W11 benchmark)	< 16 l/p/day	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G

As stated in section 2.5.2 The Embodied Carbon target is addressed only as far as our capacity as the Sustainability Consultant is concerned. In order to fully tackle the Whole Life Carbon of the building using Circular Economy Strategies; consideration of Embodied Carbon will be required by all parties involved with the design, construction and operation of the development, particularly parties with ISO14001 accreditation.

The RIBA 2030 Climate Challenge targets are ultimately non-binding however indicate good practice; we have therefore endeavoured to achieve the targets outlined.

5 CONCLUSIONS

The Energy Strategy for the proposed development St Michaels Manchester has adopted a hierarchical approach of using passive and low energy design technologies to reduce the baseline energy demand and hence CO₂ emissions followed by the feasibility of the application of low and zero carbon technologies as appropriate.

This is supported by the SAP/SBEM Calculations to provide compliance in England with the Building Regulations Part L, as current SAP 10 software has not fully released, reporting functionality is limited however reports can be produced as the software develops. The analysis has shown that by incorporating passive and low energy design measures, compliance with Part L 2012 is achieved. Furthermore, an estimated SAP 10 calculation shows that on-site CO₂ has been reduced over the baseline calculation by 22.28% therefore achieving the required 15% reduction over 2010 Building Regulations as stipulated in the Manchester Core Strategy.

This is achieved by incorporation of the following elements:

- Improved thermal transmittance U-valued as depicted.
- Air source heat pumps
- Mechanical Ventilation Heat Recovery systems with 88% heat recovery efficiency
- Highly efficient low carbon Air Source Heat Pumps
- Low building air leakage rate (5.0 m³/h/m² at a pressure differential of 50 Pa)
- 100% Low energy lighting through the buildings
- Low flow aerated showerheads and basin tap inserts to reduce water consumption
- Reducing mains/potable water via water efficient devices and equipment

A 'Fabric First' approach has been used in this strategy then, following the stages of the Energy Hierarchy, CHP and district heating has been assessed followed by a study of various low and zero carbon technologies. The graph below demonstrates the results for each stage of the Energy Hierarchy.

Figure 23: Overall CO₂ Emissions Reduction SAP 2012 Results

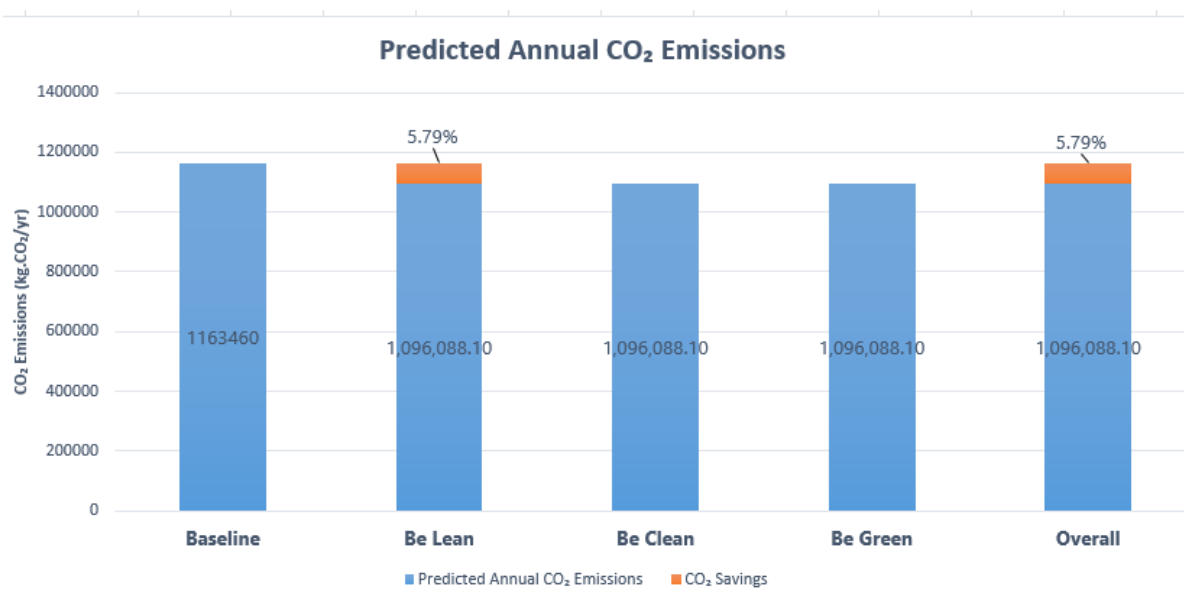
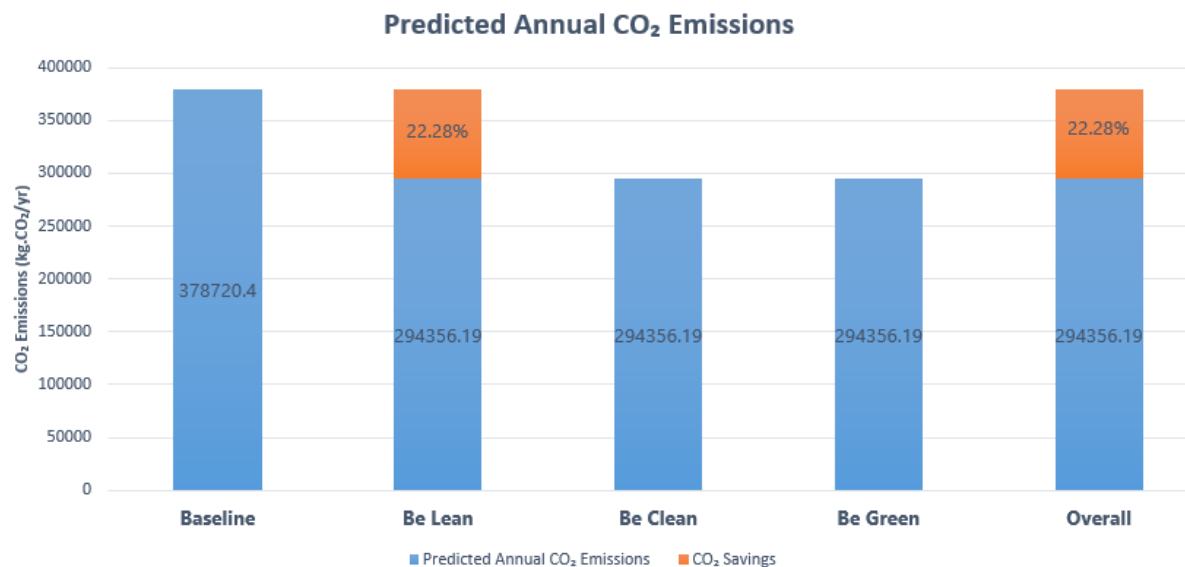


Figure 24: Overall CO₂ Emissions Reduction Estimated SAP 10 Results

A 22.28% overall reduction in CO₂ emissions can be observed. As stated previously, the Manchester Core Strategy requires a 15% improvement over Part L 2010 Building Regulations. These regulations have been superseded by 2013 and 2021 Building Regulations which collectively are a 37% betterment over 2010 Building Regulations by default. Therefore, by achieving a CO₂ reduction of 22.28% in the SAP 10 calculation graph above, this equates to a 59.28% improvement over 2010 Building Regulations and offers full compliance with the requirements of the Manchester Core Strategy.

Consideration has also been given to the RIBA 2030 Climate Challenge Targets with respect to domestic operational energy, embodied carbon and potable water use. Although RIBA plans on developing their targets further with UK professional bodies in order to obtain concrete benchmarks; we have made every effort to reach the current baselines prescribed as we share RIBA's urgency and enthusiasm in addressing the current Environment and Climate Emergency.

To summarise, the SAP 10 estimated 22.28% reduction in CO₂ has been achieved using high-performance materials to improve the building fabric u-values, incorporating highly efficient air source heat pumps for heating/cooling and installing mechanical ventilation with heat recovery. Furthermore, low energy lighting will be used throughout, and low flow rate fixtures and fittings will be used to reduce water consumption. It is therefore the conclusion of this report that the requirements of Part L and the Manchester Core Strategy have been met whilst also supporting the RIBA 2030 Climate Challenge.

6 APPENDICES

Appendix A – SAP Reports

Appendix B – BRUKL Report

Appendix A

SAP Reports (issued separately)

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:47:39

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 91.31m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 01

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.64 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.68 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

42.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

38.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m ²
Windows facing: West	6.79m ²
Windows facing: North	11.49m ²
Windows facing: North	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

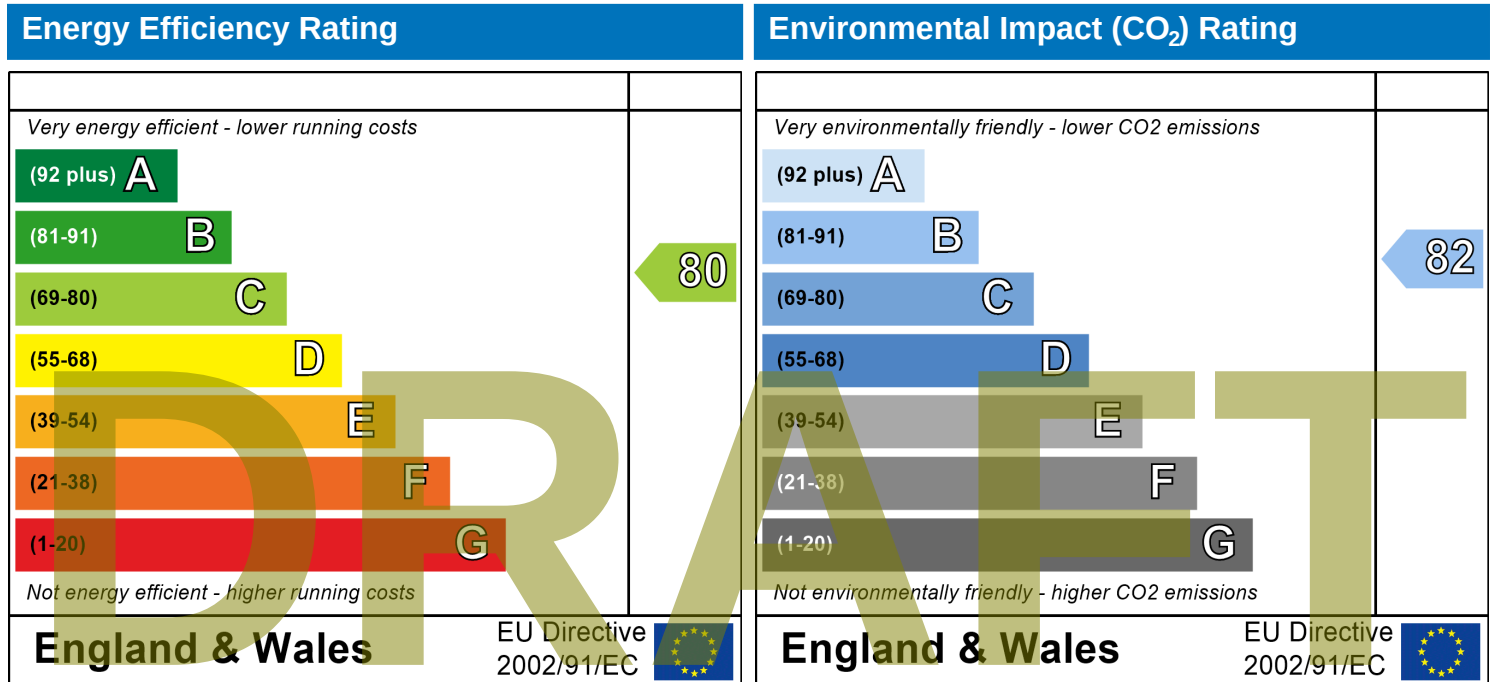
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
91.31 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	91.31 (1a) x	2.7 (2a) =	246.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.78	x 0	0		(32)
Party wall			15.36	x 0	0		(32)
Party floor			91.31				(32a)
Party ceiling			91.31				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92
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Average = Sum(39)_{1...12} /12=

75.51

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.64

 (42)

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

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

96.98

 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67

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

1163.72

 (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=

158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2
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Total = Sum(45)_{1...12} =

1525.82

 (45)

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

(46)m=

23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

190

 (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):

1.61

 (48)

Temperature factor from Table 2b

0.6

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0.97

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1878.41
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59

 (66)

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

(67)m=

53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31
-------	------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67
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 (72)

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

(73)m=

623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85
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 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

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Northwest 0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest 0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest 0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest 0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest 0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest 0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest 0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(84)
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7. Mean internal temperature (heating season)

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

21 (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=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

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

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)
--------	------	------	------	-----	------	------	------	------	------	-----	------	------	------

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

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)
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fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)
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Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(93)
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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=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)
--------	------	------	------	------	------	-----	------	------	------	-----	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(95)
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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=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)
--------	---------	---------	---------	--------	--------	--------	--------	-------	--------	--------	-------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
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SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1594.5 (98)

Space heating requirement in kWh/m²/year

17.46 (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 0 686.45 540.4 551.72 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 663.06 529.28 534.48 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1623.69 1534.83 1341.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748.13 600.35 0 0 0 0

Total = Sum(104) = 2040.14 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.65 152.13 122.08 0 0 0 0

Total = Sum(107) = 414.85 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.54 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99
--------	--------	--------	-------	-------	---	---	---	---	------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29
-----	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 937.94 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.1	27.15	21.79	0	0	0	0
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Total = Sum(221)_{6..8} = 74.05 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

937.94

Water heating fuel used

1878.41

Space cooling fuel used

74.05

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

297.02 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 297.02 (231)

Electricity for lighting

380.17 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3567.59 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.77 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18 (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 =	50.14 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		470.57 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.45	(257)
SAP rating (Section 12)		79.77	(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	0.519	=	486.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1461.69	(265)
Space cooling	(221) x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	154.15	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)...(271) =		1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =		20.28	(273)
El rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2879.48	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8646.2	(265)
Space cooling	(221) x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	911.84	(267)
Electricity for lighting	(232) x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)...(271) =		10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		119.95	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	91.31 (1a) x	2.7 (2a) =	246.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.78	x 0	0		(32)
Party wall			15.36	x 0	0		(32)
Party floor			91.31				(32a)
Party ceiling			91.31				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	
Average = Sum(39) _{1...12} /12=												75.51	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	
Average = Sum(40) _{1...12} /12=												0.83	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	
Total = Sum(44) _{1...12} =												1163.72	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	
Total = Sum(45) _{1...12} =												1525.82	(45)

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

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (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): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 0.97 (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 $(47) \times (51) \times (52) \times (53) =$ 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
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 (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)

Output from water heater

(64)m=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1878.41
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16

 (66)

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

(67)m=

21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13
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 (67)

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

(68)m=

241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81
--------	--------	--------	--------	--------	-------	--------	--------	--------	-------	--------	--------

 (68)

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

(69)m=

36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67
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 (72)

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

(73)m=

428.54	426.4	411.86	388.32	364.27	341.17	326.2	332.4	344.52	368.29	395.62	416.25
--------	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
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DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest 0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest 0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest 0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest 0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest 0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest 0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.61	681.35	852.39	1085.35	1281.2	1310.89	1236.42	1069.8	872.66	674.93	556.64	522.53	(84)
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7. Mean internal temperature (heating season)

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

21

(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=	0.96	0.93	0.85	0.7	0.51	0.35	0.26	0.31	0.54	0.82	0.94	0.97	(86)

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

(87)m=	19.31	19.64	20.13	20.65	20.89	20.98	20.99	20.99	20.91	20.49	19.82	19.28	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.92	0.84	0.67	0.47	0.31	0.21	0.26	0.49	0.79	0.93	0.96	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	17.91	18.39	19.08	19.8	20.12	20.23	20.25	20.25	20.16	19.62	18.67	17.88	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

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

(92)m=	18.57	18.98	19.58	20.2	20.49	20.59	20.6	20.6	20.51	20.03	19.22	18.54	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.57	18.98	19.58	20.2	20.49	20.59	20.6	20.6	20.51	20.03	19.22	18.54	(93)
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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=	0.94	0.9	0.82	0.67	0.48	0.33	0.23	0.28	0.51	0.78	0.91	0.95	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	524.85	615.46	701.37	722.94	620.98	429.41	290.36	301.53	442.56	528.6	507.37	496.17	(95)
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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=	1122.6	1101.01	1017.19	854.61	660.53	437.12	292.23	304.89	473.94	709.13	921.43	1102.93	(97)
--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.72	326.29	234.97	94.8	29.43	0	0	0	0	134.32	298.13	451.43	
--------	--------	--------	--------	------	-------	---	---	---	---	--------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2014.08 (98)

Space heating requirement in kWh/m²/year

22.06 (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 0 686.45 540.4 551.72 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 663.06 529.28 534.48 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1623.69 1534.83 1341.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748.13 600.35 0 0 0 0

Total = Sum(104) = 2040.14 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.65 152.13 122.08 0 0 0 0

Total = Sum(107) = 414.85 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.54 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

444.72	326.29	234.97	94.8	29.43	0	0	0	0	134.32	298.13	451.43
--------	--------	--------	------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

261.6	191.93	138.22	55.77	17.31	0	0	0	0	79.01	175.37	265.55
-------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 1184.75 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.1	27.15	21.79	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 74.05 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

1184.75

Water heating fuel used

1878.41

Space cooling fuel used

74.05

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

297.02 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 297.02 (231)

Electricity for lighting

380.17 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3814.4 (238)

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	0.519	614.89 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	974.9 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1589.78 (265)
Space cooling	(221) x	0.519	38.43 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	154.15 (267)
Electricity for lighting	(232) x	0.519	197.31 (268)
Total CO2, kg/year		sum of (265)...(271) =	1979.67 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.68 (273)
EI rating (section 14)			81 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 01

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: South
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 325.43 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 371.78 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North West (NW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
North (N)	1	0.9	1	0.9	(P8)
North (N GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North West (NW)	0.9 x 21.27	89.66	0.4	0.8	0.9	494.29
West (W)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
North (N)	0.9 x 11.49	73.49	0.4	1	0.9	273.59
North (N GLAZED DOOR)	0.9 x 2.43	73.49	0.4	0.7	0.9	40.5
Total						1047.01 (P3/P4)

Internal gains:

	June	July	August
Internal gains	490.26	470.94	479.51
Total summer gains	1640.7	1517.94	1313.96 (P5)
Summer gain/loss ratio	4.41	4.08	3.53 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.41	21.78	21.13 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:47:30

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 90.94m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 02

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.67 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.73 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

42.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

38.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m ²
Windows facing: East	6.79m ²
Windows facing: North	11.49m ²
Windows facing: North	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

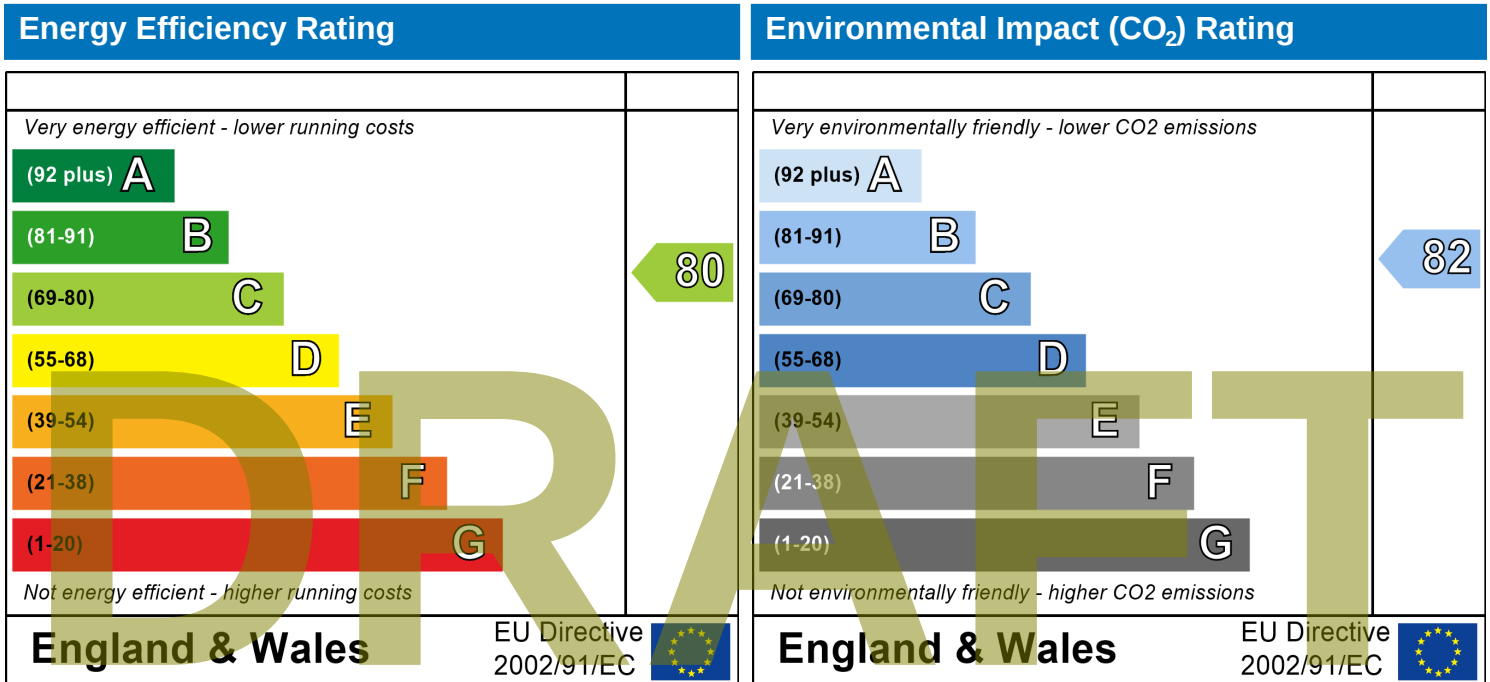
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
90.94 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	90.94 (1a) x	2.7 (2a) =	245.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	245.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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)	0.25 (18)
--	-----------

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

Number of sides sheltered	2 (19)
---------------------------	--------

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
----------------	---------------------------------------

Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.21 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.45	x 0	0		(32)
Party wall			15.57	x 0	0		(32)
Party floor			90.94				(32a)
Party ceiling			90.94				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79
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Average = Sum(39)_{1...12} /12=

75.4

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.64

 (42)

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

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

96.86

 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55

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

1162.34

 (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=

158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1524.01

 (45)

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

(46)m=

23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

190

 (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):

1.61

 (48)

Temperature factor from Table 2b

0.6

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0.97

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1876.6
---	--------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3

 (66)

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

(67)m=

53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

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East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(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=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

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

(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)
--------	------	------	------	-----	------	------	------	------	------	-----	------	------	------

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

(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	------	-------	-------	------

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

(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(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=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)
--------	------	------	------	------	------	-----	------	------	------	-----	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(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=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	-------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1590.91 (98)

Space heating requirement in kWh/m²/year

17.49 (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 0 685.45 539.61 550.92 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 662.02 528.46 533.65 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1622.66 1533.84 1340.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748 600.23 0 0 0 0

Total = Sum(104) = 2039.9 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.38 151.82 121.83 0 0 0 0

Total = Sum(107) = 414.02 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.55 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79
--------	-------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 935.83 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.06	27.1	21.74	0	0	0	0
---	---	---	---	---	-------	------	-------	---	---	---	---

Total = Sum(221)_{6..8} =

73.9 (221)

Annual totals

Space heating fuel used, main system 1

935.83

Water heating fuel used

1876.6

Space cooling fuel used

73.9

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

295.81 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

295.81 (231)

Electricity for lighting

379.12 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3561.25 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (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 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.45	(257)
SAP rating (Section 12)		79.75	(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	0.519	=	485.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1459.65	(265)
Space cooling	(221) x	0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	153.53	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)...(271) =		1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =		20.32	(273)
El rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2873	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8634.15	(265)
Space cooling	(221) x	3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	908.14	(267)
Electricity for lighting	(232) x	0	=	1163.89	(268)
'Total Primary Energy		sum of (265)...(271) =		10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		120.22	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	90.94 (1a)	2.7 (2a)	245.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	245.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.45	x 0	0		(32)
Party wall			15.57	x 0	0		(32)
Party floor			90.94				(32a)
Party ceiling			90.94				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

75.4

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.83

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.64

(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

96.86

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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)

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1162.34

(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=

158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1524.01

(45)

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

(46)m=

23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1876.6
---	--------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92

 (66)

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

(67)m=

21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06
-------	-------	-------	-------	------	------	------	-------	-------	-------	------	-------

 (67)

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

(68)m=

240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17
-------	-------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

427.65	425.51	411.01	387.52	363.54	340.49	325.56	331.75	343.84	367.55	394.81	415.4
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	556.72	680.46	851.54	1084.56	1280.46	1310.21	1235.77	1069.15	871.98	674.19	555.84	521.67	(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=	0.96	0.93	0.85	0.69	0.51	0.35	0.26	0.31	0.54	0.82	0.94	0.97	(86)

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

(87)m=	19.31	19.63	20.13	20.65	20.89	20.98	20.99	20.99	20.91	20.49	19.82	19.27	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.92	0.84	0.67	0.47	0.31	0.21	0.26	0.49	0.79	0.93	0.96	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.91	18.38	19.08	19.8	20.12	20.23	20.25	20.25	20.16	19.61	18.67	17.87	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.56	18.97	19.57	20.2	20.48	20.58	20.6	20.6	20.51	20.03	19.21	18.53	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.56	18.97	19.57	20.2	20.48	20.58	20.6	20.6	20.51	20.03	19.21	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=	0.94	0.9	0.82	0.67	0.48	0.33	0.23	0.28	0.51	0.78	0.91	0.95	(94)
--------	------	-----	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.82	614.33	700.07	721.51	619.66	428.44	289.6	300.76	441.56	527.53	506.38	495.2	(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=	1119.9	1098.48	1014.97	852.85	659.14	436.14	291.48	304.12	472.87	707.58	919.32	1100.32	(97)
--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	443.48	325.35	234.28	94.56	29.37	0	0	0	0	133.96	297.32	450.21	
--------	--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2008.53 (98)

Space heating requirement in kWh/m²/year

22.09 (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 0 685.45 539.61 550.92 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 662.02 528.46 533.65 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1622.66 1533.84 1340.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748 600.23 0 0 0 0

Total = Sum(104) = 2039.9 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.38 151.82 121.83 0 0 0 0

Total = Sum(107) = 414.02 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.55 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

443.48	325.35	234.28	94.56	29.37	0	0	0	0	133.96	297.32	450.21
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

260.87	191.38	137.81	55.62	17.28	0	0	0	0	78.8	174.89	264.83
--------	--------	--------	-------	-------	---	---	---	---	------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 1181.49 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.06	27.1	21.74	0	0	0	0
---	---	---	---	---	-------	------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 73.9 (221)

Annual totals

Space heating fuel used, main system 1

1181.49

Water heating fuel used

1876.6

Space cooling fuel used

73.9

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

295.81 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 295.81 (231)

Electricity for lighting

379.12 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3806.91 (238)

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	0.519	613.19 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	973.95 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1587.15 (265)
Space cooling	(221) x	0.519	38.35 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	153.53 (267)
Electricity for lighting	(232) x	0.519	196.76 (268)
Total CO2, kg/year		sum of (265)...(271) =	1975.79 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.73 (273)
EI rating (section 14)			81 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 02

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: South
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 324.11 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 370.46 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (NE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
North (N)	1	0.9	1	0.9	(P8)
North (N GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North East (NE)	0.9 x 21.27	89.66	0.4	0.8	0.9	494.29
East (E)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
North (N)	0.9 x 11.49	73.49	0.4	1	0.9	273.59
North (N GLAZED DOOR)	0.9 x 2.43	73.49	0.4	0.7	0.9	40.5
Total						1047.01 (P3/P4)

Internal gains:

	June	July	August
Internal gains	489.23	469.95	478.51
Total summer gains	1639.66	1516.96	1312.96 (P5)
Summer gain/loss ratio	4.43	4.09	3.54 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.43	21.79	21.14 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:47:22

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.81m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 03

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.25 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.14 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

38.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

34.3 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.86 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m ²
Windows facing: East	8.52m ²
Windows facing: South	1.57m ²
Windows facing: South	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

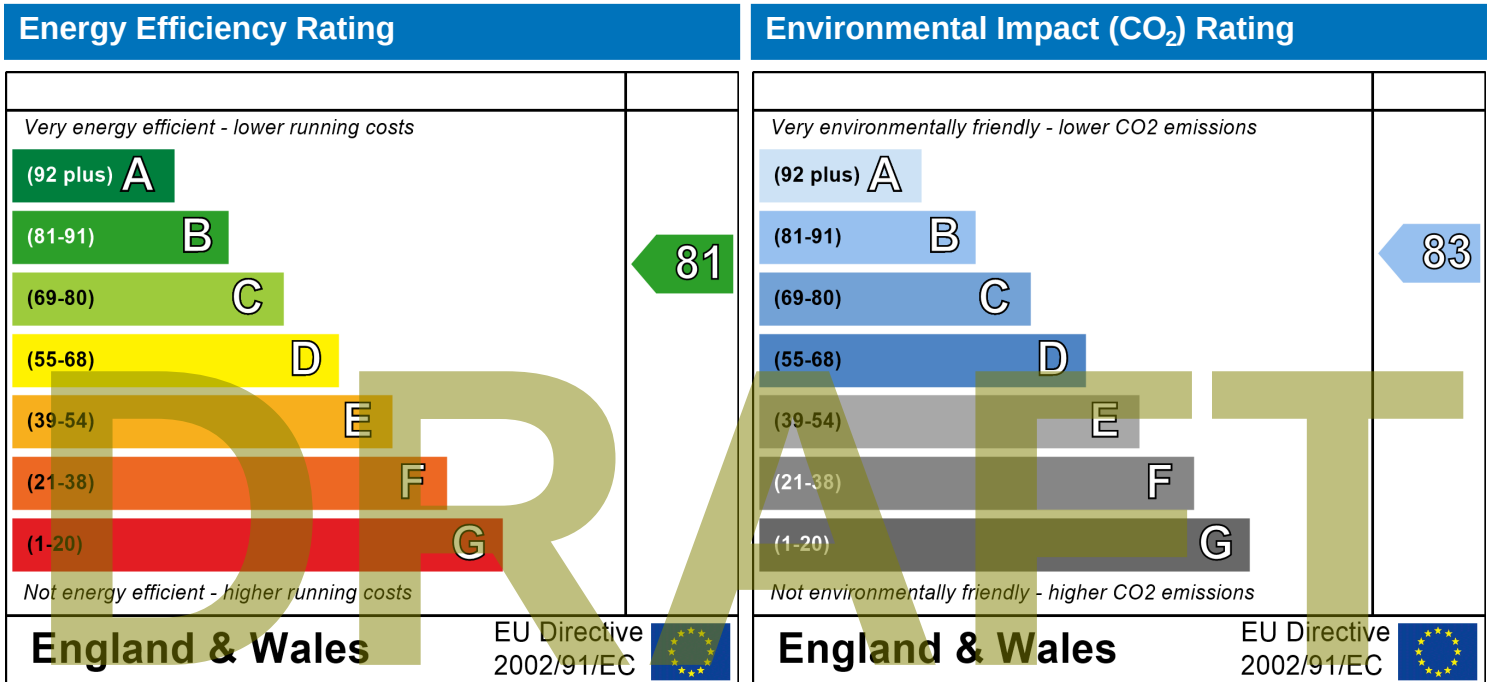
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.81 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.81 (1a)	2.7 (2a)	218.19 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.16	x 1/[1/(1) + 0.04]	20.35		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.26	33.81	7.45	x 0.24	1.79		(29)
Total area of elements, m²			41.26				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.88	x 0	0		(32)
Party floor			80.81				(32a)
Party ceiling			80.81				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
------	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

93.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.64

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01
-------	--------	-----	--------	-------	-------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1464.1

(45)

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

(46)m=

22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

SAP WorkSheet: New dwelling design stage

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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.69
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68

 (66)

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

(67)m=

49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

 (72)

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

(73)m=

581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(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=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

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

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)
--------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(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=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(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=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)
--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	-------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1070.63 (98)

Space heating requirement in kWh/m²/year

13.25 (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 0 560.93 441.58 450.87 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 548.01 435.81 442.29 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1432.38 1361.92 1222.42 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 x (98)m

(104)m = 0 0 0 0 0 636.74 689.03 580.41 0 0 0 0

Total = Sum(104) = 1906.19 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 135.29 146.4 123.32 0 0 0 0

Total = Sum(107) = 405.01 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.01 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	-------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 629.78 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.15	26.13	22.01	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 72.29 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

629.78

Water heating fuel used

1816.69

Space cooling fuel used

72.29

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.93 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.93 (231)

Electricity for lighting

348.15 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3089.84 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.54 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4 (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 =	45.92 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		407.55 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.36	(257)
SAP rating (Section 12)		81.02	(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	0.519	=	326.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1269.72	(265)
Space cooling	(221) x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.7	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year		sum of (265)...(271) =		1603.63	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.84	(273)
El rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1933.43	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7510.66	(265)
Space cooling	(221) x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	684.4	(267)
Electricity for lighting	(232) x	0	=	1068.81	(268)
'Total Primary Energy		sum of (265)...(271) =		9485.81	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		117.38	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.81 (1a)	2.7 (2a)	218.19 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	218.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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	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 (15)
---------------------	--------

Infiltration rate	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)	0.25 (18)
--	-----------

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

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.16	x 1/[1/(1) + 0.04]	20.35		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.26	33.81	7.45	x 0.24	1.79		(29)
Total area of elements, m²			41.26				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.88	x 0	0		(32)
Party floor			80.81				(32a)
Party ceiling			80.81				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.65 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
------	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

93.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.64

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01
-------	--------	-----	--------	-------	-------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1464.1

(45)

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

(46)m=

22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.69
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9

 (66)

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

(67)m=

19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26
-------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

 (72)

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

(73)m=

401.05	398.99	385.47	363.64	341.44	320.03	306.1	312.06	323.25	345.3	370.66	389.7
--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
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DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	543.95	668.86	819.97	1003.19	1144.22	1153.44	1094.56	974.21	828.6	661.64	546.76	508.73	(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=	0.95	0.9	0.81	0.65	0.48	0.33	0.24	0.28	0.48	0.76	0.91	0.95	(86)

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

(87)m=	19.59	19.93	20.36	20.76	20.93	20.99	21	20.99	20.95	20.65	20.07	19.55	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.94	0.89	0.79	0.62	0.44	0.29	0.2	0.24	0.44	0.73	0.9	0.95	(89)
--------	------	------	------	------	------	------	-----	------	------	------	-----	------	------

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

(90)m=	18.36	18.84	19.44	19.99	20.21	20.29	20.3	20.31	20.25	19.87	19.06	18.31	(90)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19	19.4	19.92	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.96	(92)
--------	----	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19	19.4	19.92	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.96	(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=	0.93	0.88	0.78	0.63	0.46	0.31	0.22	0.26	0.46	0.73	0.89	0.94	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	503.46	586.14	643.67	628.56	522.36	356.98	241.53	251.3	377.15	483.96	484.41	476.22	(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=	943.87	926.11	852.02	709.55	545.63	361.23	242.49	252.92	393.16	594.42	775.42	926.91	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	327.66	228.46	155.02	58.31	17.31	0	0	0	0	82.18	209.53	335.32	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1413.8 (98)

Space heating requirement in kWh/m²/year

17.5 (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 0 560.93 441.58 450.87 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 548.01 435.81 442.29 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1432.38 1361.92 1222.42 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 x (98)m

(104)m = 0 0 0 0 0 636.74 689.03 580.41 0 0 0 0

Total = Sum(104) = 1906.19 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 135.29 146.4 123.32 0 0 0 0

Total = Sum(107) = 405.01 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.01 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

327.66	228.46	155.02	58.31	17.31	0	0	0	0	82.18	209.53	335.32
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

192.74	134.39	91.19	34.3	10.19	0	0	0	0	48.34	123.25	197.25
--------	--------	-------	------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 831.64 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.15	26.13	22.01	0	0	0	0
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Total = Sum(221)_{6..8} = 72.29 (221)

Annual totals

Space heating fuel used, main system 1

831.64

Water heating fuel used

1816.69

Space cooling fuel used

72.29

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.93 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.93 (231)

Electricity for lighting

348.15 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3291.7 (238)

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	0.519	431.62 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	942.86 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1374.48 (265)
Space cooling	(221) x	0.519	37.52 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.7 (267)
Electricity for lighting	(232) x	0.519	180.69 (268)
Total CO2, kg/year		sum of (265)...(271) =	1708.39 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.14 (273)
EI rating (section 14)			82 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 03

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: West
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 288.01 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 325.66 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (NE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North East (NE)	0.9 x 21.16	89.66	0.4	0.8	0.9	491.73
East (E)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
South (S)	0.9 x 1.57	106.3	0.4	1	0.9	54.07
South (S GLAZED DOOR)	0.9 x 2.56	106.3	0.4	0.7	0.9	61.72
Total						906.94 (P3/P4)

Internal gains:

	June	July	August
Internal gains	458.25	440.35	448.47
Total summer gains	1446.99	1347.29	1197.77 (P5)
Summer gain/loss ratio	4.44	4.14	3.68 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.44	21.84	21.28 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:47:14

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.72m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 04

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

20.38 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

20.10 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

30.4 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (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

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m ²
Windows facing: East	8.52m ²
Windows facing: South	1.57m ²
Windows facing: South	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

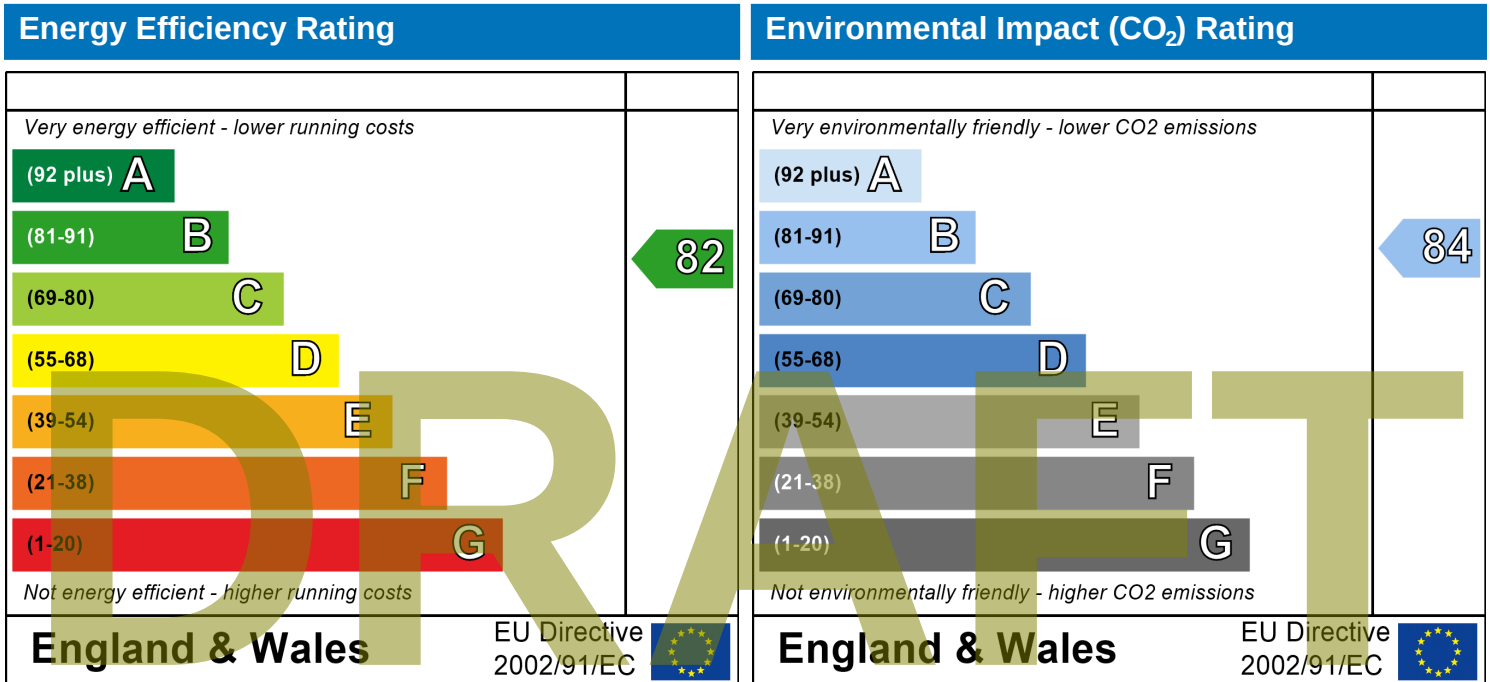
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.72 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.72 (1a)	2.7 (2a)	217.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	217.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
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SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.9	7.2	x 0.24	1.73		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.5	x 0	0		(32)
Party wall			29.89	x 0	0		(32)
Party floor			80.71				(32a)
Party ceiling			80.72				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(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=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	
Average = Sum(39) _{1...12} /12=												61.68	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	
Average = Sum(40) _{1...12} /12=												0.76	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	
Total = Sum(44) _{1...12} =												1116.17	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	
Total = Sum(45) _{1...12} =												1463.47	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

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

	190	(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):

Temperature factor from Table 2b	0.6	(49)
----------------------------------	-----	------

Energy lost from water storage, kWh/year $(48) \times (49) =$

	0.97	(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 $(47) \times (51) \times (52) \times (53) =$

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

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.06
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58

 (66)

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

(67)m=

49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21
--------	--------	--------	-------	--------	--------	-------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87
--------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(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=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

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

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)
--------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(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=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)
--------	------	------	------	-----	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(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=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
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SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 844.86 (98)

Space heating requirement in kWh/m²/year

10.47 (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 0 560.95 441.6 450.89 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.66 437.2 445.17 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1548.73 1489.38 1398.78 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 x (98)m

(104)m = 0 0 0 0 0 718.61 782.83 709.48 0 0 0 0

Total = Sum(104) = 2210.92 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 153.52 167.24 151.57 0 0 0 0

Total = Sum(107) = 472.34 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.85 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35
--------	-------	-------	------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 496.97 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	27.4	29.85	27.05	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6...8} =

84.31 (221)

Annual totals

Space heating fuel used, main system 1

496.97

Water heating fuel used

1816.06

Space cooling fuel used

84.31

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.68 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

222.68 (231)

Electricity for lighting

347.85 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

2967.88 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	65.55 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.54 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	11.12 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.37 (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 =	45.88 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		391.46 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.31	(257)
SAP rating (Section 12)		81.76	(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	0.519	=	257.93	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1200.47	(265)
Space cooling	(221) x	0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.57	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)...(271) =		1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.08	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1525.71	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7101.02	(265)
Space cooling	(221) x	3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	683.64	(267)
Electricity for lighting	(232) x	0	=	1067.91	(268)
'Total Primary Energy		sum of (265)...(271) =		9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		112.88	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.72 (1a)	2.7 (2a)	217.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	217.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.9	7.2	x 0.24	1.73		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.5	x 0	0		(32)
Party wall			29.89	x 0	0		(32)
Party floor			80.71				(32a)
Party ceiling			80.72				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.68 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
-----	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

93.01

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.17

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94
--------	-------	--------	--------	--------	-------	------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1463.47

(45)

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

(46)m=

22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.06
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82

 (66)

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

(67)m=

19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24
------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	-------	--------

 (68)

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

(69)m=

35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87
--------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

400.79	398.73	385.23	363.41	341.22	319.83	305.92	311.86	323.05	345.09	370.42	389.45
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

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East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	664.13	856.17	1029.66	1184.78	1276.2	1253.05	1203.67	1125.15	1029.36	856.14	687.58	613.63	(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=	0.91	0.83	0.73	0.58	0.43	0.3	0.22	0.24	0.39	0.65	0.85	0.93	(86)

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

(87)m=	19.82	20.21	20.56	20.83	20.95	20.99	21	21	20.97	20.79	20.29	19.76	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.9	0.82	0.7	0.55	0.4	0.27	0.18	0.21	0.36	0.62	0.84	0.92	(89)
--------	-----	------	-----	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.68	19.23	19.71	20.08	20.23	20.3	20.3	20.31	20.27	20.04	19.37	18.61	(90)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.28	19.74	20.15	20.47	20.6	20.66	20.67	20.67	20.64	20.43	19.85	19.21	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.28	19.74	20.15	20.47	20.6	20.66	20.67	20.67	20.64	20.43	19.85	19.21	(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=	0.89	0.81	0.7	0.56	0.41	0.29	0.2	0.22	0.37	0.63	0.82	0.9	(94)
--------	------	------	-----	------	------	------	-----	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	589.06	690.89	721.01	658.43	529.4	358.14	241.88	252.05	385.8	535.73	566.76	554.43	(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=	961.55	947.38	867.03	714.85	546.83	361.45	242.58	253.08	394.6	603.91	791.87	942.83	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	277.13	172.37	108.64	40.62	12.97	0	0	0	0	50.72	162.08	288.97	
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DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1113.5 (98)

Space heating requirement in kWh/m²/year

13.79 (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 0 560.95 441.6 450.89 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.66 437.2 445.17 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1548.73 1489.38 1398.78 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 x (98)m

(104)m = 0 0 0 0 0 718.61 782.83 709.48 0 0 0 0

Total = Sum(104) = 2210.92 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 153.52 167.24 151.57 0 0 0 0

Total = Sum(107) = 472.34 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.85 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

277.13	172.37	108.64	40.62	12.97	0	0	0	0	50.72	162.08	288.97
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

163.02	101.39	63.91	23.89	7.63	0	0	0	0	29.84	95.34	169.98
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 655 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

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

1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	27.4	29.85	27.05	0	0	0	0
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Total = Sum(221)_{6..8} =

84.31 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

655

Water heating fuel used

1816.06

Space cooling fuel used

84.31

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.68

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

222.68 (231)

Electricity for lighting

347.85 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3125.91 (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	0.519	339.94 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	942.54 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1282.48 (265)
Space cooling	(221) x	0.519	43.76 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.57 (267)
Electricity for lighting	(232) x	0.519	180.54 (268)
Total CO2, kg/year		sum of (265)...(271) =	1622.35 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	20.1 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 04

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: West
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 287.69 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 325.37 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South East (SE)	0.9 x 21.25	112.1	0.4	0.8	0.9	617.45
East (E)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
South (S)	0.9 x 1.57	106.3	0.4	1	0.9	54.07
South (S GLAZED DOOR)	0.9 x 2.56	106.3	0.4	0.7	0.9	61.72
Total						1032.67 (P3/P4)

Internal gains:

	June	July	August
Internal gains	457.96	440.06	448.18
Total summer gains	1565.09	1472.73	1368.5 (P5)
Summer gain/loss ratio	4.81	4.53	4.21 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.81	22.23	21.81 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:47:06

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.5m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 05

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

18.79 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

18.66 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

29.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m ²
Windows facing: East	6.79m ²
Windows facing: South	11.46m ²
Windows facing: South	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

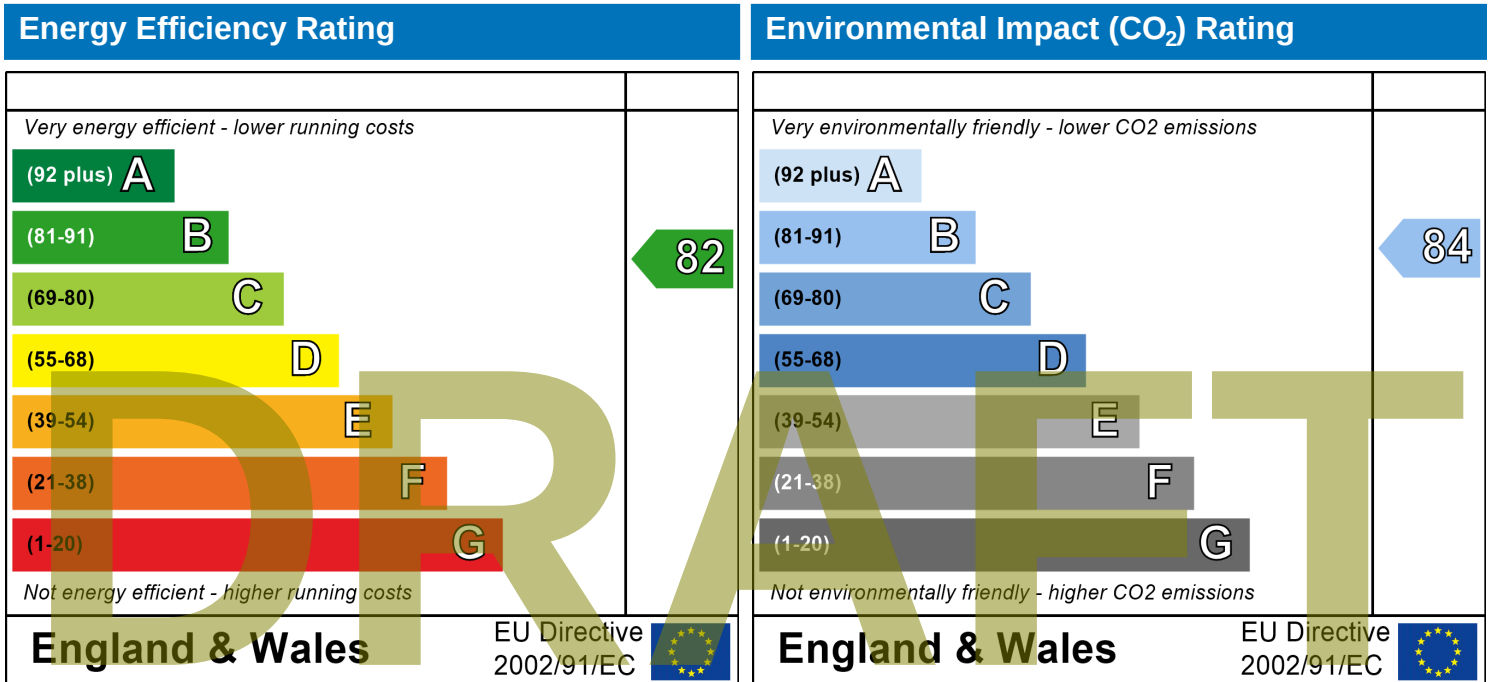
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
99.5 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.5 (1a)	2.7 (2a)	268.65 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.65 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.4	x 1/[1/(1) + 0.04]	20.58		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.4	42.08	8.32	x 0.24	2		(29)
Total area of elements, m²			50.4				(31)
Party wall			70.09	x 0	0		(32)
Party wall			7.3	x 0	0		(32)
Party floor			99.5				(32a)
Party ceiling			99.5				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

78.19

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8
------	------	------	------	------	------	------	------	------	------	------	-----

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.79

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.73

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

99.15

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07
--------	-------	--------	-------	------	-------	-------	------	-------	--------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1189.83

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1560.06

(45)

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

(46)m=

24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1912.65
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09

 (66)

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

(67)m=

56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------

 (67)

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

(68)m=

381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)
--------	--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

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

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(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=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

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

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(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=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(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=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)
--------	---------	---------	---------	--------	--------	--------	-------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	-------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1120.49 (98)

Space heating requirement in kWh/m²/year

11.26 (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 0 709.5 558.55 570.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 694.16 551.93 561.83 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1892.94 1826.12 1734.68 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 x (98)m

(104)m = 0 0 0 0 0 863.12 948 872.6 0 0 0 0

Total = Sum(104) = 2683.72 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.83 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 179.98 197.67 181.95 0 0 0 0

Total = Sum(107) = 559.6 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67
--------	--------	--------	-------	-------	---	---	---	---	-------	-------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 659.11 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

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

1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.12	35.28	32.48	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} =

99.88 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

659.11

Water heating fuel used

1912.65

Space cooling fuel used

99.88

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.66

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

323.66

(231)

Electricity for lighting

402.29

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3397.59

(238)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.94 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.28 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.17 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.69 (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 =	53.06 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		448.14 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.3	(257)
SAP rating (Section 12)		81.83	(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	0.519	=	342.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1334.74	(265)
Space cooling	(221) x	0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	167.98	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)...(271) =		1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.72	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2023.47	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7895.3	(265)
Space cooling	(221) x	3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	993.62	(267)
Electricity for lighting	(232) x	0	=	1235.04	(268)
'Total Primary Energy		sum of (265)...(271) =		10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		104.83	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.5 (1a)	2.7 (2a)	268.65 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.65 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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)
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Additional infiltration	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)
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If no draught lobby, enter 0.05, else enter 0	0 (13)
---	--------

Percentage of windows and doors draught stripped	0 (14)
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Window infiltration	0 (15)
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Infiltration rate	0 (16)
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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)	0.25 (18)
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Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered	2 (19)
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Shelter factor	0.85 (20)
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Infiltration rate incorporating shelter factor	0.21 (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
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DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.4	x 1/[1/(1) + 0.04]	20.58		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.4	42.08	8.32	x 0.24	2		(29)
Total area of elements, m²			50.4				(31)
Party wall			70.09	x 0	0		(32)
Party wall			7.3	x 0	0		(32)
Party floor			99.5				(32a)
Party ceiling			99.5				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.41 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	
(39)m=	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	
Average = Sum(39) _{1...12} /12=												78.19	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	
(40)m=	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	
Average = Sum(40) _{1...12} /12=												0.79	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	

(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	
Total = Sum(44) _{1...12} =												1189.83	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times nm \times DTm / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	
(45)m=	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	
Total = Sum(45) _{1...12} =												1560.06	(45)

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

	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	
(46)m=	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	(46)

Water storage loss:

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

	190	(47)
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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):

	1.61	(48)
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Temperature factor from Table 2b	0.6	(49)
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Energy lost from water storage, kWh/year $(48) \times (49) =$

	0.97	(50)
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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 $(47) \times (51) \times (52) \times (53) =$	0	(54)
---	---	------

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

	0.97	(55)
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Water storage loss calculated for each month $((56)m = (55) \times (41)m$

	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	
(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
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 (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)

Output from water heater

(64)m=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1912.65
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74

 (66)

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

(67)m=

22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

446.8	444.62	429.4	404.71	379.42	355.18	339.51	345.85	358.59	383.51	412.17	433.88
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)
--------	--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

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

(84)m=	828.94	1093.7	1311.27	1484.8	1576.14	1537.08	1481.59	1402.12	1309.45	1099.33	869.58	761.09	(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=	0.91	0.83	0.72	0.58	0.44	0.31	0.22	0.24	0.39	0.64	0.85	0.93	(86)

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

(87)m=	19.77	20.19	20.54	20.82	20.94	20.99	21	21	20.97	20.79	20.27	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.9	0.81	0.7	0.55	0.41	0.28	0.19	0.21	0.35	0.61	0.83	0.92	(89)
--------	-----	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.59	19.18	19.67	20.05	20.2	20.28	20.29	20.29	20.25	20.02	19.32	18.52	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.17	19.67	20.1	20.43	20.56	20.63	20.63	20.64	20.6	20.4	19.78	19.1	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	------	------

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

(93)m=	19.17	19.67	20.1	20.43	20.56	20.63	20.63	20.64	20.6	20.4	19.78	19.1	(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=	0.89	0.8	0.69	0.56	0.42	0.29	0.2	0.23	0.37	0.62	0.82	0.9	(94)
--------	------	-----	------	------	------	------	-----	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	734.38	874.61	910.23	827.22	665.22	449.91	303.5	316.27	485.56	677.08	712.94	687.69	(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=	1213.45	1198.69	1096.85	902.51	689.9	454.78	304.55	317.73	497.05	762.53	999.27	1187.72	(97)
--------	---------	---------	---------	--------	-------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	356.42	217.79	138.84	54.21	18.37	0	0	0	0	63.58	206.16	372.02	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1427.39 (98)

Space heating requirement in kWh/m²/year

14.35 (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 0 709.5 558.55 570.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 694.16 551.93 561.83 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1892.94 1826.12 1734.68 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 x (98)m

(104)m = 0 0 0 0 0 863.12 948 872.6 0 0 0 0

Total = Sum(104) = 2683.72 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.83 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 179.98 197.67 181.95 0 0 0 0

Total = Sum(107) = 559.6 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

356.42	217.79	138.84	54.21	18.37	0	0	0	0	63.58	206.16	372.02
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

209.66	128.11	81.67	31.89	10.8	0	0	0	0	37.4	121.27	218.84
--------	--------	-------	-------	------	---	---	---	---	------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 839.64 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.12	35.28	32.48	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 99.88 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

839.64

Water heating fuel used

1912.65

Space cooling fuel used

99.88

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.66 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 323.66 (231)

Electricity for lighting

402.29 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3578.12 (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	0.519	435.77 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	992.66 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1428.44 (265)
Space cooling	(221) x	0.519	51.84 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	167.98 (267)
Electricity for lighting	(232) x	0.519	208.79 (268)
Total CO2, kg/year		sum of (265)...(271) =	1857.04 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.66 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 05

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: North
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 354.62 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 401.03 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South East (SE)	0.9 x 21.4	112.1	0.4	0.8	0.9	621.81
East (E)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
South (S)	0.9 x 11.46	106.3	0.4	1	0.9	394.69
South (S GLAZED DOOR)	0.9 x 2.43	106.3	0.4	0.7	0.9	58.58
Total						1313.71 (P3/P4)

Internal gains:

	June	July	August
Internal gains	511.49	491.22	500.07
Total summer gains	1913.66	1804.93	1695.37 (P5)
Summer gain/loss ratio	4.77	4.5	4.23 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.77	22.2	21.83 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:58

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.42m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 06

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

18.79 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

18.67 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

29.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m ²
Windows facing: West	6.79m ²
Windows facing: South	11.46m ²
Windows facing: South	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

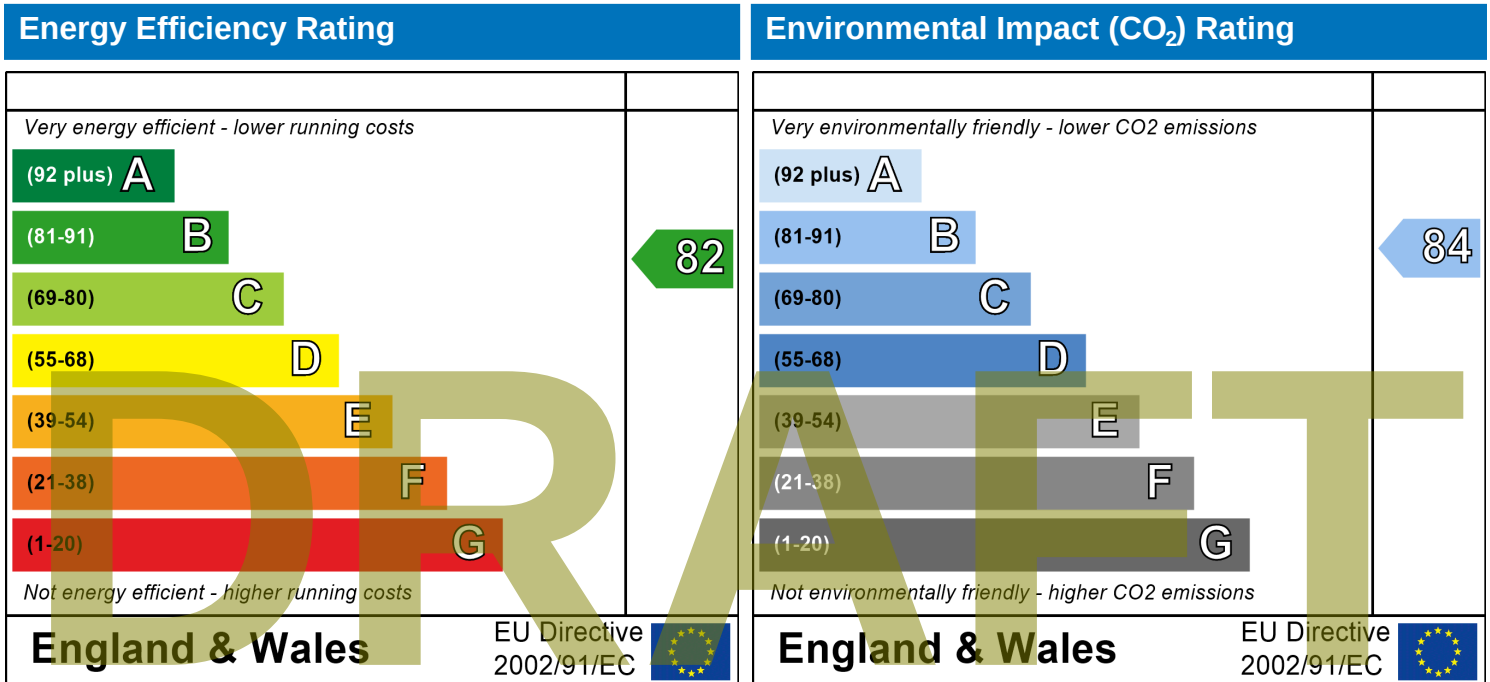
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
99.42 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 06

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.42 (1a) x	2.7 (2a) =	268.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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)	0.25 (18)
--	-----------

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

Number of sides sheltered	2 (19)
---------------------------	--------

Shelter factor	(20) = 1 - [0.075 x (19)] = 0.85 (20)
----------------	---------------------------------------

Infiltration rate incorporating shelter factor	(21) = (18) x (20) = 0.21 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.39	41.95	8.44	x 0.24	2.03		(29)
Total area of elements, m²			50.39				(31)
Party wall			62.33	x 0	0		(32)
Party wall			15.01	x 0	0		(32)
Party floor			99.42				(32a)
Party ceiling			99.42				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

78.06

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8
------	------	------	------	------	------	------	------	------	------	------	-----

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.79

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.73

(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

99.13

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1189.62

(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=

161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1559.77

(45)

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

(46)m=

24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49
-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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)

Output from water heater

(64)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual) ^{1...12}	1912.36
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05

 (66)

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

(67)m=

56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (67)

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

(68)m=

381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	------	--------

 (72)

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

(73)m=

651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)
--------	--------	--------	-------	---------	---------	--------	---------	---------	--------	--------	--------	-------	------

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

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(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=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

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

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(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=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(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=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)
--------	---------	---------	---------	-------	--------	--------	--------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1118.38 (98)

Space heating requirement in kWh/m²/year

11.25 (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 0 708.37 557.66 569.15 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 693.06 551.06 560.94 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1888.77 1822.1 1730.98 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 x (98)m

(104)m = 0 0 0 0 0 860.91 945.66 870.51 0 0 0 0

Total = Sum(104) = 2677.08 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.84 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 180.35 198.11 182.36 0 0 0 0

Total = Sum(107) = 560.82 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.64 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16
--------	--------	-------	-------	------	---	---	---	---	------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 657.87 (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)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Total = Sum(219a)_{1..12} = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0
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Total = Sum(221)_{6..8} = 100.1 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

657.87

Water heating fuel used

1912.36

Space cooling fuel used

100.1

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.4

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

323.4

(231)

Electricity for lighting

402.09

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3395.82

(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (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 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.3	(257)
SAP rating (Section 12)		81.83	(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	0.519	=	341.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1333.95	(265)
Space cooling	(221) x	0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	167.84	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)...(271) =		1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.73	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2019.67	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7890.63	(265)
Space cooling	(221) x	3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	992.83	(267)
Electricity for lighting	(232) x	0	=	1234.41	(268)
'Total Primary Energy		sum of (265)...(271) =		10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		104.86	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 06

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.42 (1a)	2.7 (2a)	268.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.39	41.95	8.44	x 0.24	2.03		(29)
Total area of elements, m²			50.39				(31)
Party wall			62.33	x 0	0		(32)
Party wall			15.01	x 0	0		(32)
Party floor			99.42				(32a)
Party ceiling			99.42				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.31 (37)

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Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

78.06

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8
------	------	------	------	------	------	------	------	------	------	------	-----

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.79

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.73

(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

99.13

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1189.62

(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=

161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1559.77

(45)

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

(46)m=

24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49
-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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)

Output from water heater

(64)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual) ^{1...12}	1912.36
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7

 (66)

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

(67)m=

22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

 (67)

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

(68)m=

255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (68)

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

(69)m=

36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	------	--------

 (72)

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

(73)m=

446.64	444.45	429.24	404.57	379.28	355.05	339.39	345.72	358.47	383.37	412.01	433.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)
--------	--------	--------	-------	---------	---------	--------	---------	---------	--------	--------	--------	-------	------

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

(84)m=	827.72	1091.72	1308.64	1481.59	1572.57	1533.55	1478.19	1398.99	1306.64	1097.19	868.16	760.03	(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=	0.91	0.83	0.72	0.58	0.44	0.31	0.22	0.24	0.39	0.64	0.85	0.93	(86)

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

(87)m=	19.77	20.19	20.54	20.82	20.94	20.99	21	21	20.97	20.79	20.27	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.9	0.81	0.7	0.55	0.41	0.28	0.19	0.21	0.35	0.61	0.83	0.92	(89)
--------	-----	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.6	19.18	19.67	20.05	20.2	20.28	20.29	20.29	20.25	20.02	19.32	18.52	(90)
--------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.17	19.68	20.1	20.43	20.56	20.63	20.64	20.64	20.6	20.4	19.79	19.1	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	------	------

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

(93)m=	19.17	19.68	20.1	20.43	20.56	20.63	20.64	20.64	20.6	20.4	19.79	19.1	(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=	0.89	0.8	0.69	0.56	0.42	0.29	0.21	0.23	0.37	0.62	0.82	0.9	(94)
--------	------	-----	------	------	------	------	------	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	733.38	873.25	908.78	825.91	664.19	449.22	303.04	315.79	484.82	676.04	711.9	686.79	(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=	1211.69	1196.91	1095.19	901.12	688.85	454.08	304.09	317.25	496.29	761.37	997.78	1186	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	355.86	217.49	138.68	54.15	18.35	0	0	0	0	63.49	205.83	371.41	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

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

1425.27

 (98)

Space heating requirement in kWh/m²/year

14.34

 (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	708.37	557.66	569.15	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

 (100)

Utilisation factor for loss hm

(101)m =

0	0	0	0	0	0.98	0.99	0.99	0	0	0	0
---	---	---	---	---	------	------	------	---	---	---	---

 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m =

0	0	0	0	0	693.06	551.06	560.94	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m =

0	0	0	0	0	1888.77	1822.1	1730.98	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 x (98)m

(104)m =

0	0	0	0	0	860.91	945.66	870.51	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

Total = Sum(104) =

2677.08

 (104)

Cooled fraction

f C = cooled area ÷ (4) =

0.84

 (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) =

0

 (106)

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

(107)m =

0	0	0	0	0	180.35	198.11	182.36	0	0	0	0
---	---	---	---	---	--------	--------	--------	---	---	---	---

Total = Sum(107) =

560.82

 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) =

5.64

 (108)

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) x [1 – (203)] =

1

 (204)

Efficiency of main space heating system 1

170

 (206)

Efficiency of secondary/supplementary heating system, %

0

 (208)

Cooling System Energy Efficiency Ratio

5.6

 (209)

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

kWh/year

Space heating requirement (calculated above)

355.86	217.49	138.68	54.15	18.35	0	0	0	0	63.49	205.83	371.41
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

209.33	127.94	81.58	31.85	10.79	0	0	0	0	37.35	121.08	218.48
--------	--------	-------	-------	-------	---	---	---	---	-------	--------	--------

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

838.4

 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Total = Sum(219a)_{1..12} = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 100.1 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

838.4

Water heating fuel used

1912.36

Space cooling fuel used

100.1

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.4 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 323.4 (231)

Electricity for lighting

402.09 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3576.35 (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	0.519	435.13 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	992.52 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1427.64 (265)
Space cooling	(221) x	0.519	51.95 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	167.84 (267)
Electricity for lighting	(232) x	0.519	208.68 (268)
Total CO2, kg/year		sum of (265)...(271) =	1856.12 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.67 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 06

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: North
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 354.33 (P1)
Transmission heat loss coefficient: 46.3
Summer heat loss coefficient: 400.65 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South West (SW)	0.9 x 21.27	112.1	0.4	0.8	0.9	618.03
West (W)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
South (S)	0.9 x 11.46	106.3	0.4	1	0.9	394.69
South (S GLAZED DOOR)	0.9 x 2.43	106.3	0.4	0.7	0.9	58.58
Total						1309.93 (P3/P4)

Internal gains:

	June	July	August
Internal gains	511.3	491.04	499.89
Total summer gains	1909.43	1800.97	1691.77 (P5)
Summer gain/loss ratio	4.77	4.5	4.22 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.77	22.2	21.82 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:51

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.75m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 07

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

20.85 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

20.36 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

34.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

31.4 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (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

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m ²
Windows facing: West	8.52m ²
Windows facing: North	1.57m ²
Windows facing: North	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

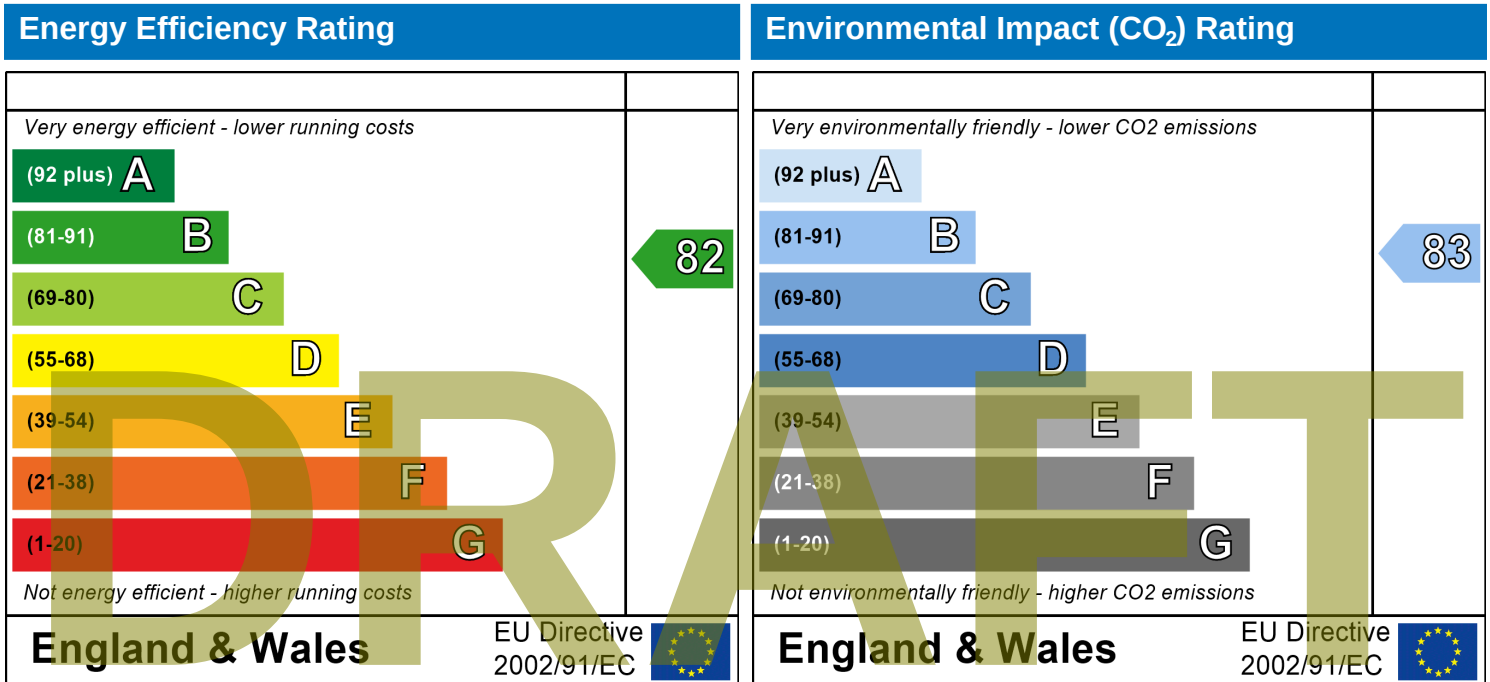
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.75 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 07

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.75 (1a) x	2.7 (2a) =	218.03 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.03 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (7a)
Number of passive vents				0 x 10 =	0 (7b)
Number of flueless gas fires				0 x 40 =	0 (7c)

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.92	7.18	x 0.24	1.72		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.95	x 0	0		(32)
Party floor			80.75				(32a)
Party ceiling			80.75				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(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=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	
Average = Sum(39) _{1...12} /12=												61.7	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	
Average = Sum(40) _{1...12} /12=												0.76	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	
Total = Sum(44) _{1...12} =												1116.33	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	
Total = Sum(45) _{1...12} =												1463.68	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (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): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 0.97 (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 $(47) \times (51) \times (52) \times (53) =$ 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.27
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62

 (66)

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

(67)m=

49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62
-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(86)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(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=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

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

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)
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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)
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Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(93)
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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
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Utilisation factor for gains, hm:

(94)m=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(95)
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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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 902.34 (98)

Space heating requirement in kWh/m²/year

11.17 (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
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m = 0 0 0 0 0 561.16 441.77 451.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.19 437.01 444.67 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1516.15 1453.76 1349.69 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 x (98)m

(104)m = 0 0 0 0 0 695.49 756.46 673.34 0 0 0 0

Total = Sum(104) = 2125.29 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 148.53 161.55 143.8 0 0 0 0

Total = Sum(107) = 453.88 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31
--------	--------	-------	-------	-------	---	---	---	---	------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24
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Total (kWh/year) =Sum(211)_{1...5,10...12}= 530.79 (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)

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Water heating

Output from water heater (calculated above)

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
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Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
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Total = Sum(219a)_{1..12} =

1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0
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Total = Sum(221)_{6..8} =

81.01 (221)

Annual totals

Space heating fuel used, main system 1

530.79

Water heating fuel used

1816.27

Space cooling fuel used

81.01

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.77 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

222.77 (231)

Electricity for lighting

347.95 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

2998.79 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	70.01 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.57 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	10.69 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.38 (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 =	45.89 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		395.54 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.32	(257)
SAP rating (Section 12)		81.57	(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	0.519	=	275.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1218.13	(265)
Space cooling	(221) x	0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.62	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)...(271) =		1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.27	(273)
El rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1629.53	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7205.48	(265)
Space cooling	(221) x	3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	683.89	(267)
Electricity for lighting	(232) x	0	=	1068.21	(268)
'Total Primary Energy		sum of (265)...(271) =		9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		114.01	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 07

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.75 (1a) x	2.7 (2a) =	218.03 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.03 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.92	7.18	x 0.24	1.72		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.95	x 0	0		(32)
Party floor			80.75				(32a)
Party ceiling			80.75				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83
-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.7

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
-----	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

93.03

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.33

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96
--------	--------	--------	-------	--------	-------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1463.68

(45)

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

(46)m=

22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.27
---	---------

 (64)

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

(65)m=

74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85

 (66)

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

(67)m=

19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25
------	------	-------	-------	------	-----	------	------	-------	-------	----	-------

 (67)

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

(68)m=

221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

400.88	398.82	385.31	363.48	341.29	319.9	305.98	311.93	323.12	345.16	370.5	389.53
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	-------	--------

 (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)
--------------	---------------------------	------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(86)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	630.72	804.12	971.41	1134.29	1239.37	1225.15	1173.17	1083.14	973.58	802.1	648.44	584.46	(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=	0.92	0.85	0.75	0.59	0.44	0.31	0.22	0.25	0.41	0.68	0.87	0.93	(86)

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

(87)m=	19.76	20.14	20.51	20.81	20.94	20.99	21	21	20.97	20.76	20.24	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.91	0.84	0.73	0.57	0.41	0.28	0.19	0.21	0.38	0.65	0.85	0.93	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.6	19.13	19.65	20.06	20.23	20.3	20.3	20.31	20.27	20.01	19.29	18.53	(90)
--------	------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.2	19.65	20.1	20.45	20.6	20.66	20.66	20.67	20.63	20.4	19.78	19.14	(92)
--------	------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	19.2	19.65	20.1	20.45	20.6	20.66	20.66	20.67	20.63	20.4	19.78	19.14	(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=	0.9	0.83	0.72	0.57	0.43	0.29	0.21	0.23	0.39	0.65	0.84	0.91	(94)
--------	-----	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	566.49	664.63	702.5	651.51	527.85	357.99	241.89	251.98	384.12	524.13	545.87	533.64	(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=	957.19	942.39	863.76	713.86	546.74	361.54	242.65	253.14	394.45	602.01	787.98	938.9	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	290.68	186.66	119.98	44.89	14.06	0	0	0	0	57.95	174.32	301.51	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1190.04 (98)

Space heating requirement in kWh/m²/year

14.74 (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 0 561.16 441.77 451.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.19 437.01 444.67 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1516.15 1453.76 1349.69 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 x (98)m

(104)m = 0 0 0 0 0 695.49 756.46 673.34 0 0 0 0

Total = Sum(104) = 2125.29 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 148.53 161.55 143.8 0 0 0 0

Total = Sum(107) = 453.88 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

290.68	186.66	119.98	44.89	14.06	0	0	0	0	57.95	174.32	301.51
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

170.99	109.8	70.58	26.41	8.27	0	0	0	0	34.09	102.54	177.36
--------	-------	-------	-------	------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 700.02 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	26.51	28.84	25.67	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 81.01 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

700.02

Water heating fuel used

1816.27

Space cooling fuel used

81.01

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.77

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

222.77

(231)

Electricity for lighting

347.95

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3168.03

(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	0.519	= 363.31 (261)
Space heating (secondary)	(215) x	0.519	= 0 (263)
Water heating	(219) x	0.519	= 942.64 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1305.96 (265)
Space cooling	(221) x	0.519	= 42.05 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	= 115.62 (267)
Electricity for lighting	(232) x	0.519	= 180.59 (268)
Total CO2, kg/year		sum of (265)...(271) =	1644.21 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	20.36 (273)
EI rating (section 14)			82 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 07

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: East
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 287.79 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 325.49 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
North (N)	1	0.9	1	0.9	(P8)
North (N GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South West (SW)	0.9 x 21.27	112.1	0.4	0.8	0.9	618.03
West (W)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
North (N)	0.9 x 1.57	73.49	0.4	1	0.9	37.38
North (N GLAZED DOOR)	0.9 x 2.56	73.49	0.4	0.7	0.9	42.67
Total						997.51 (P3/P4)

Internal gains:

	June	July	August
Internal gains	458.05	440.16	448.28
Total summer gains	1532.02	1437.67	1320.98 (P5)
Summer gain/loss ratio	4.71	4.42	4.06 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.71	22.12	21.66 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:43

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.45m²

Site Reference : P1785 St Michaels

Plot Reference: Level 37 Flat 37 08

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.29 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.21 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

38.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

34.4 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: North West	21.25m ²
Windows facing: West	8.52m ²
Windows facing: South	1.57m ²
Windows facing: South	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

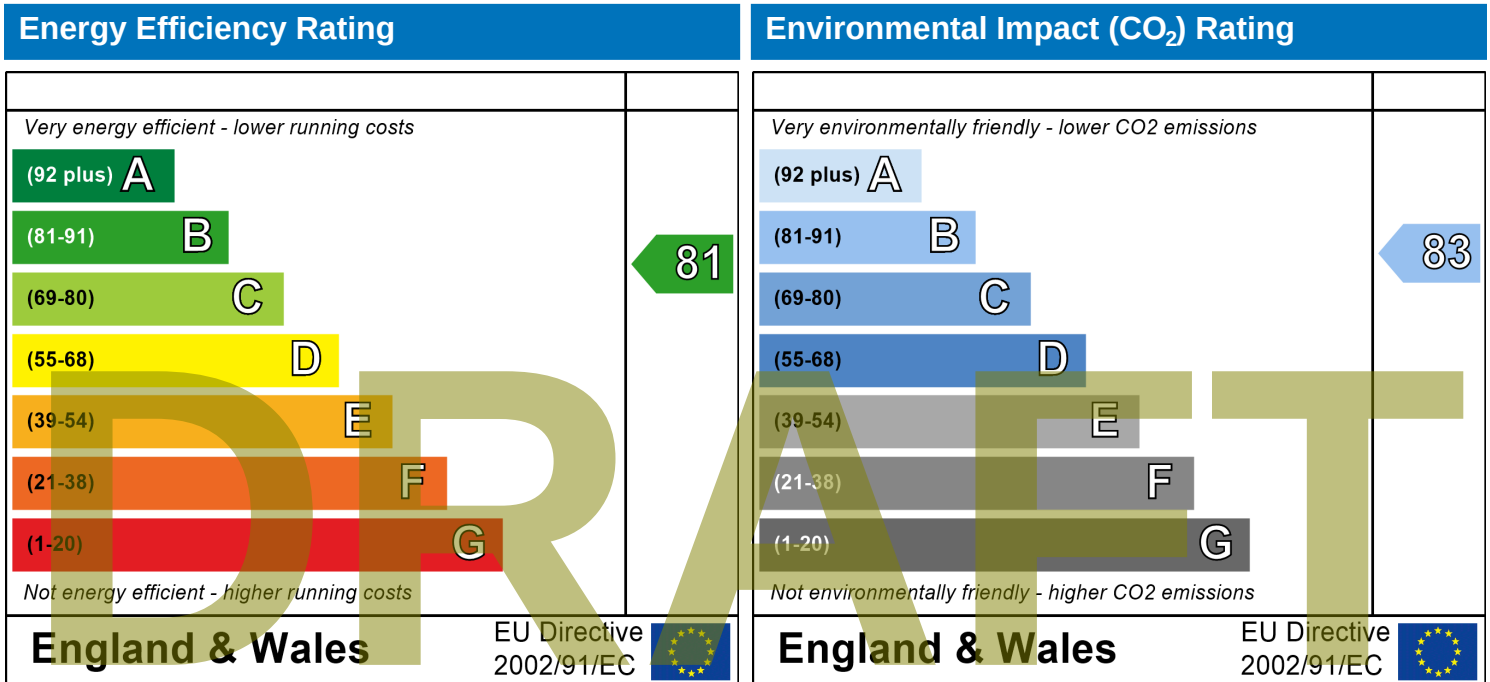
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.45 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 08

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.45 (1a)	2.7 (2a)	217.21 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	217.21 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.22	33.9	7.32	x 0.24	1.76		(29)
Total area of elements, m²			41.22				(31)
Party wall			35.41	x 0	0		(32)
Party wall			29.66	x 0	0		(32)
Party floor			80.45				(32a)
Party ceiling			80.45				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.71 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.63

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78
-----	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.77

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.47

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

92.89

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18
--------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1114.73

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75
--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1461.59

(45)

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

(46)m=

22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

 (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)

Output from water heater

(64)m=

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Output from water heater (annual) _{1...12}	1814.18
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75
-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28	148.28

 (66)

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

(67)m=

49.12	43.63	35.48	26.86	20.08	16.95	18.32	23.81	31.95	40.57	47.36	50.48
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

328.92	332.34	323.74	305.42	282.31	260.59	246.07	242.66	251.26	269.57	292.69	314.41
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3	52.3
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

579.69	575.46	554.26	521.27	487.44	457.05	439.2	447.31	466.2	499.4	536.38	564.4
--------	--------	--------	--------	--------	--------	-------	--------	-------	-------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

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South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

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Northwest 0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest 0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest 0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest 0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest 0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest 0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest 0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	------

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

(84)m=	722.81	845.79	989.59	1162.18	1292.05	1292.41	1229.47	1110.91	972.55	816.3	712.76	683.62	(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=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.41	0.67	0.84	0.9	(86)

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

(87)m=	19.92	20.19	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	------

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

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.82	19.2	19.66	20.07	20.23	20.3	20.3	20.31	20.27	20.01	19.41	18.79	(90)
--------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52

(91)

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

(92)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(92)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.4	19.72	20.11	20.46	20.61	20.66	20.67	20.67	20.63	20.41	19.89	19.36	(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=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	626.14	685.25	707.73	654.71	529.59	358.21	241.74	251.8	383.61	526.75	579.03	601.12	(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=	968.32	945.45	863.8	713.68	546.48	361.23	242.41	252.88	393.99	601.87	793.66	951.49	(97)
--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1071.67 (98)

Space heating requirement in kWh/m²/year

13.32 (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 0 560.53 441.27 450.55 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 547.56 435.46 441.93 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1433.45 1362.9 1222.95 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 x (98)m

(104)m = 0 0 0 0 0 637.84 690.01 581.08 0 0 0 0

Total = Sum(104) = 1908.93 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.86 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 136.45 147.61 124.3 0 0 0 0

Total = Sum(107) = 408.36 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.08 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

254.58	174.85	116.12	42.46	12.56	0	0	0	0	55.88	154.53	260.68
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

149.75	102.86	68.3	24.98	7.39	0	0	0	0	32.87	90.9	153.34
--------	--------	------	-------	------	---	---	---	---	-------	------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 630.39 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

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

1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.35	26.35	22.19	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} =

72.89 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

630.39

Water heating fuel used

1814.18

Space cooling fuel used

72.89

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

221.94 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

221.94 (231)

Electricity for lighting

346.97 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3086.37 (238)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.15 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.29 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.61 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.27 (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 =	45.77 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		407.09 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.36	(257)
SAP rating (Section 12)		80.99	(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	0.519	=	327.17	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	941.56	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1268.73	(265)
Space cooling	(221) x	0.519	=	37.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.19	(267)
Electricity for lighting	(232) x	0.519	=	180.08	(268)
Total CO2, kg/year		sum of (265)...(271) =		1601.83	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.91	(273)
El rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1935.31	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5569.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7504.85	(265)
Space cooling	(221) x	3.07	=	223.77	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	681.35	(267)
Electricity for lighting	(232) x	0	=	1065.2	(268)
'Total Primary Energy		sum of (265)...(271) =		9475.17	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		117.78	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 37 Flat 37 08

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.45 (1a)	2.7 (2a)	217.21 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.45 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	217.21 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.22	33.9	7.32	x 0.24	1.76		(29)
Total area of elements, m²			41.22				(31)
Party wall			35.41	x 0	0		(32)
Party wall			29.66	x 0	0		(32)
Party floor			80.45				(32a)
Party ceiling			80.45				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.35 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16803.42 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.71 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.43	26.09	25.74	24	23.66	21.92	21.92	21.57	22.62	23.66	24.35	25.05

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.14	63.8	63.45	61.71	61.37	59.63	59.63	59.28	60.33	61.37	62.06	62.76
-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.63

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.74	0.75	0.76	0.77	0.78
-----	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.77

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.47

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

92.89

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.18	98.47	94.75	91.04	87.32	83.6	83.6	87.32	91.04	94.75	98.47	102.18
--------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1114.73

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.54	132.53	136.76	119.23	114.41	98.72	91.48	104.98	106.23	123.8	135.14	146.75
--------	--------	--------	--------	--------	-------	-------	--------	--------	-------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1461.59

(45)

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

(46)m=

22.73	19.88	20.51	17.89	17.16	14.81	13.72	15.75	15.93	18.57	20.27	22.01
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

 (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)

Output from water heater

(64)m=

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Output from water heater (annual) ^{1...12}	1814.18
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.34	65.71	69.43	62.83	62	56.01	54.37	58.86	58.51	65.12	68.12	72.75
-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57	123.57

 (66)

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

(67)m=

19.65	17.45	14.19	10.74	8.03	6.78	7.33	9.52	12.78	16.23	18.94	20.19
-------	-------	-------	-------	------	------	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

220.38	222.67	216.9	204.63	189.15	174.59	164.87	162.58	168.35	180.61	196.1	210.65
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36	35.36
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85	-98.85
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

99.92	97.78	93.32	87.26	83.33	77.79	73.08	79.12	81.26	87.53	94.61	97.79
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

400.02	397.96	384.48	362.71	340.58	319.23	305.35	311.29	322.46	344.44	369.72	388.7
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)
South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)
West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)
Northwest	0.9x	0.77	x	21.25	x	11.28	x	0.4	x	0.8	=	53.17	(81)
Northwest	0.9x	0.77	x	21.25	x	22.97	x	0.4	x	0.8	=	108.23	(81)
Northwest	0.9x	0.77	x	21.25	x	41.38	x	0.4	x	0.8	=	194.99	(81)
Northwest	0.9x	0.77	x	21.25	x	67.96	x	0.4	x	0.8	=	320.24	(81)
Northwest	0.9x	0.77	x	21.25	x	91.35	x	0.4	x	0.8	=	430.46	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	21.25	x	97.38	x	0.4	x	0.8	=	458.91	(81)
Northwest 0.9x	0.77	x	21.25	x	91.1	x	0.4	x	0.8	=	429.31	(81)
Northwest 0.9x	0.77	x	21.25	x	72.63	x	0.4	x	0.8	=	342.25	(81)
Northwest 0.9x	0.77	x	21.25	x	50.42	x	0.4	x	0.8	=	237.6	(81)
Northwest 0.9x	0.77	x	21.25	x	28.07	x	0.4	x	0.8	=	132.26	(81)
Northwest 0.9x	0.77	x	21.25	x	14.2	x	0.4	x	0.8	=	66.9	(81)
Northwest 0.9x	0.77	x	21.25	x	9.21	x	0.4	x	0.8	=	43.42	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	143.13	270.33	435.32	640.91	804.61	835.36	790.27	663.6	506.35	316.9	176.38	119.21	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	------

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

(84)m=	543.14	668.29	819.81	1003.62	1145.19	1154.59	1095.62	974.89	828.81	661.34	546.1	507.92	(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=	0.95	0.9	0.81	0.65	0.47	0.33	0.24	0.28	0.48	0.76	0.91	0.95	(86)

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

(87)m=	19.59	19.92	20.35	20.76	20.93	20.99	21	20.99	20.95	20.65	20.07	19.55	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.3	20.3	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	------	------	-------	------	-------	-------	-------	------

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

(89)m=	0.94	0.89	0.79	0.62	0.44	0.29	0.2	0.24	0.43	0.73	0.9	0.95	(89)
--------	------	------	------	------	------	------	-----	------	------	------	-----	------	------

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

(90)m=	18.35	18.83	19.44	19.99	20.21	20.29	20.3	20.3	20.25	19.87	19.05	18.31	(90)
--------	-------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52

(91)

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

(92)m=	19	19.4	19.91	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.95	(92)
--------	----	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19	19.4	19.91	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.95	(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=	0.93	0.88	0.78	0.63	0.46	0.31	0.22	0.26	0.45	0.73	0.89	0.94	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	502.55	585.31	642.93	627.95	521.89	356.73	241.39	251.14	376.81	483.34	483.61	475.32	(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=	942.76	925.11	851.18	708.95	545.2	361	242.35	252.78	392.88	593.89	774.62	925.87	(97)
--------	--------	--------	--------	--------	-------	-----	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	327.52	228.34	154.93	58.32	17.34	0	0	0	0	82.25	209.53	335.21	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1413.45 (98)

Space heating requirement in kWh/m²/year

17.57 (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 0 560.53 441.27 450.55 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 547.56 435.46 441.93 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1433.45 1362.9 1222.95 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 x (98)m

(104)m = 0 0 0 0 0 637.84 690.01 581.08 0 0 0 0

Total = Sum(104) = 1908.93 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.86 (105)

Intermittency factor (Table 10b)

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

Total = Sum(106) = 0 (106)

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

(107)m = 0 0 0 0 0 136.45 147.61 124.3 0 0 0 0

Total = Sum(107) = 408.36 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.08 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

327.52	228.34	154.93	58.32	17.34	0	0	0	0	82.25	209.53	335.21
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

192.66	134.32	91.14	34.31	10.2	0	0	0	0	48.38	123.25	197.18
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 831.44 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.48	159.58	166.71	148.21	144.35	127.7	121.43	134.92	135.21	153.75	164.12	176.7
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	-------

Total = Sum(219a)_{1..12} = 1814.18 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.35	26.35	22.19	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 72.89 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

831.44

Water heating fuel used

1814.18

Space cooling fuel used

72.89

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

221.94 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 221.94 (231)

Electricity for lighting

346.97 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3287.42 (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	0.519	431.52 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	941.56 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1373.08 (265)
Space cooling	(221) x	0.519	37.83 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.19 (267)
Electricity for lighting	(232) x	0.519	180.08 (268)
Total CO2, kg/year		sum of (265)...(271) =	1706.17 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.21 (273)
EI rating (section 14)			82 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 37 Flat 37 08

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: East
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 286.72 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 324.43 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North West (NW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North West (NW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North West (NW)	0.9 x 21.25	89.66	0.4	0.8	0.9	493.82
West (W)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
South (S)	0.9 x 1.57	106.3	0.4	1	0.9	54.07
South (S GLAZED DOOR)	0.9 x 2.56	106.3	0.4	0.7	0.9	61.72
Total						909.03 (P3/P4)

Internal gains:

	June	July	August
Internal gains	457.05	439.2	447.31
Total summer gains	1448.1	1348.23	1198.25 (P5)
Summer gain/loss ratio	4.46	4.16	3.69 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.46	21.86	21.29 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:35

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 91.31m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 01

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.64 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.68 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

42.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

38.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (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

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North West	21.27m ²
Windows facing: West	6.79m ²
Windows facing: North	11.49m ²
Windows facing: North	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

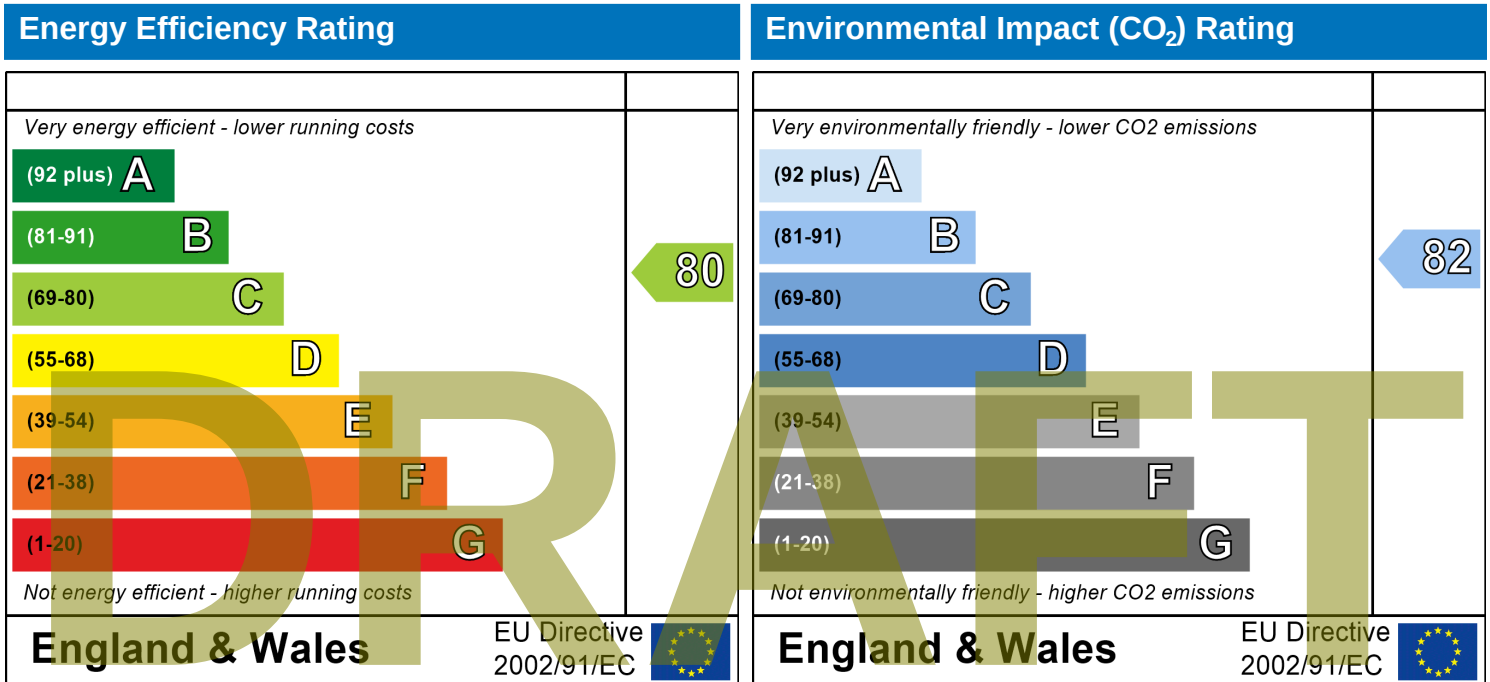
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
91.31 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	91.31 (1a) x	2.7 (2a) =	246.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.78	x 0	0		(32)
Party wall			15.36	x 0	0		(32)
Party floor			91.31				(32a)
Party ceiling			91.31				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92
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Average = Sum(39)_{1...12} /12=

75.51

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.64

 (42)

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

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

96.98

 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67

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

1163.72

 (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=

158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2
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Total = Sum(45)_{1...12} =

1525.82

 (45)

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

(46)m=

23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

190

 (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):

1.61

 (48)

Temperature factor from Table 2b

0.6

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0.97

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1878.41
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9
-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59	158.59

 (66)

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

(67)m=

53.82	47.8	38.87	29.43	22	18.57	20.07	26.09	35.01	44.46	51.89	55.31
-------	------	-------	-------	----	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

360.4	364.14	354.71	334.65	309.33	285.52	269.62	265.88	275.31	295.37	320.69	344.5
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5	53.5
------	------	------	------	------	------	------	------	------	------	------	------

 (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=

-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67
-------	--------	-------	-------	-------	------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

623.48	618.96	595.96	560.13	523.27	490.26	470.94	479.51	500.1	536.15	576.3	606.85
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

SAP WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest 0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest 0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest 0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest 0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest 0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest 0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	752.55	873.91	1036.49	1257.16	1440.2	1459.98	1381.16	1216.92	1028.24	842.8	737.32	713.12	(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=	0.92	0.88	0.79	0.63	0.46	0.32	0.23	0.27	0.47	0.74	0.88	0.93	(86)

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

(87)m=	19.65	19.93	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.62	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)
--------	------	------	------	-----	------	------	------	------	------	-----	------	------	------

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

(90)m=	18.4	18.79	19.36	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.37	(90)
--------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	------	-------	-------	------

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

(93)m=	18.99	19.33	19.82	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.96	(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=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)
--------	------	------	------	------	------	-----	------	------	------	-----	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	670.72	739.8	787.88	761.97	632.82	431.86	291	302.81	455.03	592.09	625.68	643.26	(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=	1155.12	1128.54	1035.75	862.18	662.64	437.53	292.34	305.1	476.14	722.06	947.1	1135.18	(97)
--------	---------	---------	---------	--------	--------	--------	--------	-------	--------	--------	-------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99	
--------	--------	--------	--------	-------	-------	---	---	---	---	------	--------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1594.5 (98)

Space heating requirement in kWh/m²/year

17.46 (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 0 686.45 540.4 551.72 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 663.06 529.28 534.48 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1623.69 1534.83 1341.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748.13 600.35 0 0 0 0

Total = Sum(104) = 2040.14 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.65 152.13 122.08 0 0 0 0

Total = Sum(107) = 414.85 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.54 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

360.39	261.24	184.41	72.16	22.19	0	0	0	0	96.7	231.42	365.99
--------	--------	--------	-------	-------	---	---	---	---	------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

212	153.67	108.48	42.44	13.05	0	0	0	0	56.88	136.13	215.29
-----	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 937.94 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.1	27.15	21.79	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 74.05 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

937.94

Water heating fuel used

1878.41

Space cooling fuel used

74.05

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

297.02 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 297.02 (231)

Electricity for lighting

380.17 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3567.59 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.71 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.76 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.77 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.18 (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 =	50.14 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		470.57 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.45	(257)
SAP rating (Section 12)		79.77	(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	0.519	=	486.79	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	974.9	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1461.69	(265)
Space cooling	(221) x	0.519	=	38.43	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	154.15	(267)
Electricity for lighting	(232) x	0.519	=	197.31	(268)
Total CO2, kg/year		sum of (265)...(271) =		1851.58	(272)
CO2 emissions per m²		(272) ÷ (4) =		20.28	(273)
El rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2879.48	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5766.72	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8646.2	(265)
Space cooling	(221) x	3.07	=	227.33	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	911.84	(267)
Electricity for lighting	(232) x	0	=	1167.13	(268)
'Total Primary Energy		sum of (265)...(271) =		10952.5	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		119.95	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 01

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	91.31 (1a) x	2.7 (2a) =	246.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	91.31 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	246.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.78	x 0	0		(32)
Party wall			15.36	x 0	0		(32)
Party floor			91.31				(32a)
Party ceiling			91.31				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19406.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	32.29	31.86	31.43	29.27	28.84	26.67	26.67	26.24	27.54	28.84	29.7	30.56	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	78.65	78.21	77.78	75.62	75.19	73.03	73.03	72.59	73.89	75.19	76.05	76.92	
Average = Sum(39) _{1...12} /12=												75.51	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.86	0.86	0.85	0.83	0.82	0.8	0.8	0.8	0.81	0.82	0.83	0.84	
Average = Sum(40) _{1...12} /12=												0.83	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 96.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	106.67	102.8	98.92	95.04	91.16	87.28	87.28	91.16	95.04	98.92	102.8	106.67	
Total = Sum(44) _{1...12} =												1163.72	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times \text{nm} \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	158.2	138.36	142.77	124.47	119.44	103.06	95.5	109.59	110.9	129.24	141.08	153.2	
Total = Sum(45) _{1...12} =												1525.82	(45)

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

(46)m=	23.73	20.75	21.42	18.67	17.92	15.46	14.33	16.44	16.64	19.39	21.16	22.98	(46)
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Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (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): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 0.97 (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 $(47) \times (51) \times (52) \times (53) =$ 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)
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DER WorkSheet: New dwelling design stage

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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
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 (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)

Output from water heater

(64)m=

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1878.41
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.56	67.64	71.43	64.57	63.67	57.45	55.71	60.4	60.06	66.93	70.09	74.9
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16	132.16

 (66)

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

(67)m=

21.53	19.12	15.55	11.77	8.8	7.43	8.03	10.43	14	17.78	20.75	22.13
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 (67)

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

(68)m=

241.47	243.97	237.66	224.22	207.25	191.3	180.65	178.14	184.45	197.9	214.87	230.81
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 (68)

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

(69)m=

36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22	36.22
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73	-105.73
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 (71)

Water heating gains (Table 5)

(72)m=

102.9	100.66	96.01	89.68	85.58	79.8	74.88	81.18	83.41	89.96	97.35	100.67
-------	--------	-------	-------	-------	------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

428.54	426.4	411.86	388.32	364.27	341.17	326.2	332.4	344.52	368.29	395.62	416.25
--------	-------	--------	--------	--------	--------	-------	-------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)
West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)
Northwest	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(81)
Northwest	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(81)
Northwest	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(81)
Northwest	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(81)
Northwest	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(81)

DER WorkSheet: New dwelling design stage

Northwest 0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(81)
Northwest 0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(81)
Northwest 0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(81)
Northwest 0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(81)
Northwest 0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(81)
Northwest 0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(81)
Northwest 0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(81)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	557.61	681.35	852.39	1085.35	1281.2	1310.89	1236.42	1069.8	872.66	674.93	556.64	522.53	(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=	0.96	0.93	0.85	0.7	0.51	0.35	0.26	0.31	0.54	0.82	0.94	0.97	(86)

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

(87)m=	19.31	19.64	20.13	20.65	20.89	20.98	20.99	20.99	20.91	20.49	19.82	19.28	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.25	20.23	20.22	20.22	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.92	0.84	0.67	0.47	0.31	0.21	0.26	0.49	0.79	0.93	0.96	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.91	18.39	19.08	19.8	20.12	20.23	20.25	20.25	20.16	19.62	18.67	17.88	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47

(91)

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

(92)m=	18.57	18.98	19.58	20.2	20.49	20.59	20.6	20.6	20.51	20.03	19.22	18.54	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.57	18.98	19.58	20.2	20.49	20.59	20.6	20.6	20.51	20.03	19.22	18.54	(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=	0.94	0.9	0.82	0.67	0.48	0.33	0.23	0.28	0.51	0.78	0.91	0.95	(94)
--------	------	-----	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	524.85	615.46	701.37	722.94	620.98	429.41	290.36	301.53	442.56	528.6	507.37	496.17	(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=	1122.6	1101.01	1017.19	854.61	660.53	437.12	292.23	304.89	473.94	709.13	921.43	1102.93	(97)
--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.72	326.29	234.97	94.8	29.43	0	0	0	0	134.32	298.13	451.43	
--------	--------	--------	--------	------	-------	---	---	---	---	--------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2014.08 (98)

Space heating requirement in kWh/m²/year

22.06 (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 0 686.45 540.4 551.72 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 663.06 529.28 534.48 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1623.69 1534.83 1341.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748.13 600.35 0 0 0 0

Total = Sum(104) = 2040.14 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.65 152.13 122.08 0 0 0 0

Total = Sum(107) = 414.85 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.54 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

444.72	326.29	234.97	94.8	29.43	0	0	0	0	134.32	298.13	451.43
--------	--------	--------	------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

261.6	191.93	138.22	55.77	17.31	0	0	0	0	79.01	175.37	265.55
-------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 1184.75 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

188.14	165.41	172.72	153.45	149.38	132.04	125.45	139.54	139.88	159.19	170.06	183.15
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1878.41 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.1	27.15	21.79	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 74.05 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

1184.75

Water heating fuel used

1878.41

Space cooling fuel used

74.05

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

297.02 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 297.02 (231)

Electricity for lighting

380.17 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3814.4 (238)

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	0.519	614.89 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	974.9 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1589.78 (265)
Space cooling	(221) x	0.519	38.43 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	154.15 (267)
Electricity for lighting	(232) x	0.519	197.31 (268)
Total CO2, kg/year		sum of (265)...(271) =	1979.67 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.68 (273)
EI rating (section 14)			81 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 01

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: South
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 325.43 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 371.78 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North West (NW)	0	1
West (W)	0	1
North (N)	0	1
North (N GLAZED DOOR)0		1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North West (NW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
North (N)	1	0.9	1	0.9	(P8)
North (N GLAZED DOOR)1		0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North West (NW)	0.9 x 21.27	89.66	0.4	0.8	0.9	494.29
West (W)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
North (N)	0.9 x 11.49	73.49	0.4	1	0.9	273.59
North (N GLAZED DOOR)0.9 x	2.43	73.49	0.4	0.7	0.9	40.5
Total						1047.01 (P3/P4)

Internal gains:

	June	July	August
Internal gains	490.26	470.94	479.51
Total summer gains	1640.7	1517.94	1313.96 (P5)
Summer gain/loss ratio	4.41	4.08	3.53 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.41	21.78	21.13 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:27

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 90.94m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 02

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.67 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.73 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

42.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

38.2 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North East	21.27m ²
Windows facing: East	6.79m ²
Windows facing: North	11.49m ²
Windows facing: North	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

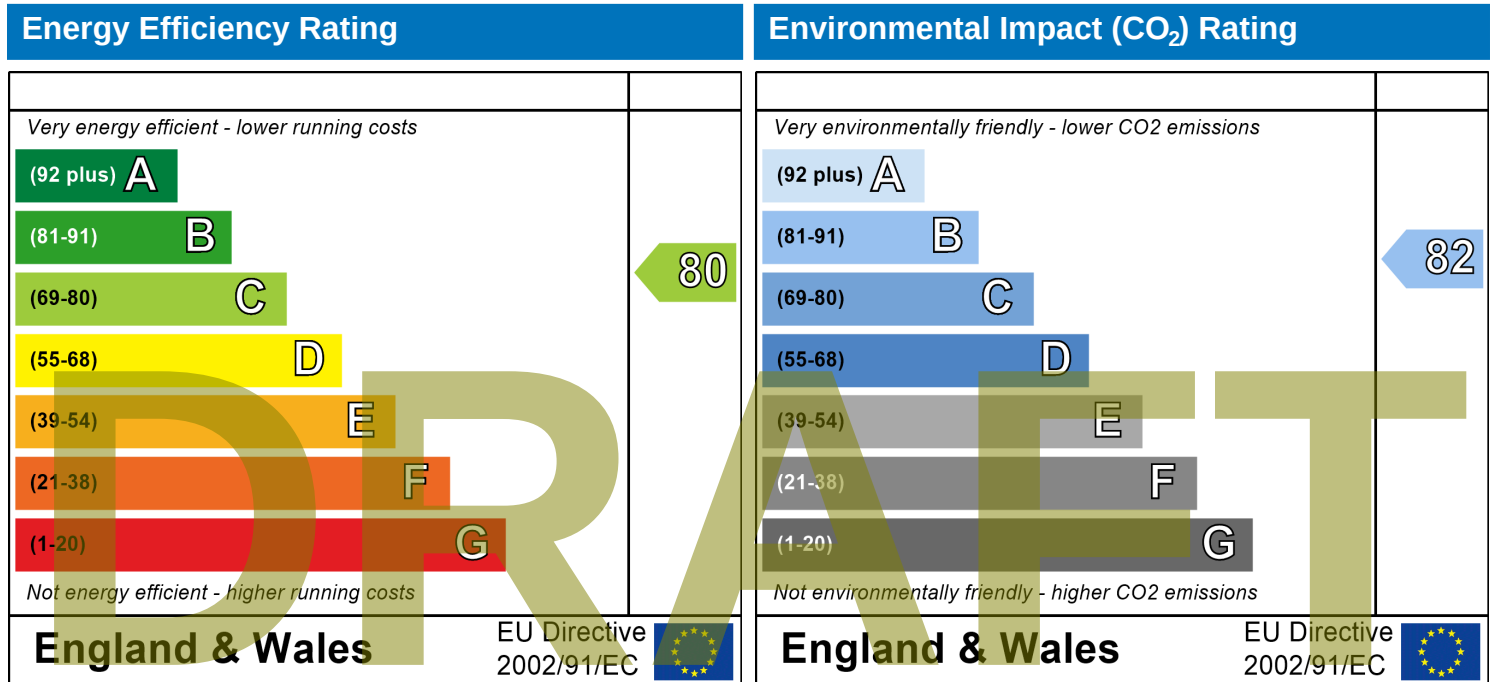
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
90.94 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	90.94 (1a) x	2.7 (2a) =	245.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	245.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.45	x 0	0		(32)
Party wall			15.57	x 0	0		(32)
Party floor			90.94				(32a)
Party ceiling			90.94				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

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

75.4

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.64

 (42)

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

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

96.86

 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55

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

1162.34

 (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=

158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1524.01

 (45)

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

(46)m=

23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

190

 (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):

1.61

 (48)

Temperature factor from Table 2b

0.6

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0.97

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1876.6
---	--------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3	158.3

 (66)

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

(67)m=

53.67	47.67	38.77	29.35	21.94	18.52	20.01	26.01	34.91	44.33	51.74	55.16
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

359.4	363.13	353.73	333.72	308.47	284.73	268.87	265.14	274.54	294.55	319.8	343.54
-------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (68)

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

(69)m=

53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47	53.47
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

622.12	617.61	594.66	558.92	522.15	489.23	469.95	478.51	499.04	535.01	575.06	605.52
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	751.18	872.56	1035.19	1255.95	1439.08	1458.94	1380.17	1215.91	1027.19	841.65	736.08	711.8	(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=	0.92	0.88	0.79	0.63	0.46	0.31	0.23	0.27	0.47	0.73	0.88	0.93	(86)

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

(87)m=	19.64	19.92	20.33	20.73	20.92	20.98	21	20.99	20.94	20.64	20.1	19.61	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.91	0.86	0.77	0.6	0.43	0.28	0.19	0.23	0.42	0.7	0.86	0.92	(89)
--------	------	------	------	-----	------	------	------	------	------	-----	------	------	------

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

(90)m=	18.39	18.79	19.35	19.91	20.15	20.24	20.25	20.25	20.19	19.81	19.06	18.36	(90)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	------	-------	-------	------

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

(93)m=	18.98	19.32	19.81	20.3	20.51	20.59	20.6	20.6	20.54	20.2	19.55	18.95	(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=	0.89	0.85	0.76	0.61	0.44	0.3	0.21	0.25	0.44	0.7	0.85	0.9	(94)
--------	------	------	------	------	------	-----	------	------	------	-----	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	669.19	738.2	786.23	760.37	631.46	430.88	290.24	302.04	453.98	590.76	624.27	641.79	(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=	1152.43	1126.01	1033.51	860.42	661.25	436.56	291.58	304.33	475.08	720.5	944.99	1132.58	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	-------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1590.91 (98)

Space heating requirement in kWh/m²/year

17.49 (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 0 685.45 539.61 550.92 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 662.02 528.46 533.65 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1622.66 1533.84 1340.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748 600.23 0 0 0 0

Total = Sum(104) = 2039.9 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.38 151.82 121.83 0 0 0 0

Total = Sum(107) = 414.02 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.55 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

359.52	260.61	183.98	72.03	22.17	0	0	0	0	96.53	230.92	365.15
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

211.48	153.3	108.22	42.37	13.04	0	0	0	0	56.78	135.84	214.79
--------	-------	--------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 935.83 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.06	27.1	21.74	0	0	0	0
---	---	---	---	---	-------	------	-------	---	---	---	---

Total = Sum(221)_{6..8} =

73.9 (221)

Annual totals

Space heating fuel used, main system 1

935.83

Water heating fuel used

1876.6

Space cooling fuel used

73.9

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

295.81 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

295.81 (231)

Electricity for lighting

379.12 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3561.25 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	123.44 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	247.52 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.75 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	39.02 (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 =	50.01 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		469.73 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.45	(257)
SAP rating (Section 12)		79.75	(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	0.519	=	485.7	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	973.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1459.65	(265)
Space cooling	(221) x	0.519	=	38.35	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	153.53	(267)
Electricity for lighting	(232) x	0.519	=	196.76	(268)
Total CO2, kg/year		sum of (265)...(271) =		1848.29	(272)
CO2 emissions per m²		(272) ÷ (4) =		20.32	(273)
El rating (section 14)				82	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2873	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5761.15	(264)
Space and water heating	(261) + (262) + (263) + (264) =			8634.15	(265)
Space cooling	(221) x	3.07	=	226.87	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	908.14	(267)
Electricity for lighting	(232) x	0	=	1163.89	(268)
'Total Primary Energy		sum of (265)...(271) =		10933.05	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		120.22	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 02

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	90.94 (1a)	2.7 (2a)	245.54 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	90.94 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	245.54 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.49	x 1/[1/(1) + 0.04]	11.05		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.44	41.98	8.46	x 0.24	2.03		(29)
Total area of elements, m²			50.44				(31)
Party wall			53.45	x 0	0		(32)
Party wall			15.57	x 0	0		(32)
Party floor			90.94				(32a)
Party ceiling			90.94				(32b)
Internal wall **			163.24				(32c)

* 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) = 42.4 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 19337.2 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.96 (36)

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

Total fabric heat loss (33) + (36) = 46.35 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
32.16	31.73	31.3	29.15	28.72	26.57	26.57	26.14	27.43	28.72	29.58	30.44

 (38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

78.52	78.09	77.66	75.5	75.07	72.92	72.92	72.49	73.78	75.07	75.93	76.79
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

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

75.4

 (39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.86	0.86	0.85	0.83	0.83	0.8	0.8	0.8	0.81	0.83	0.83	0.84
------	------	------	------	------	-----	-----	-----	------	------	------	------

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

0.83

 (40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

 (41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

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

2.64

 (42)

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

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

96.86

 (43)

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

(44)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
106.55	102.67	98.8	94.92	91.05	87.18	87.18	91.05	94.92	98.8	102.67	106.55

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

1162.34

 (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=

158.01	138.19	142.6	124.33	119.29	102.94	95.39	109.46	110.77	129.09	140.91	153.02
--------	--------	-------	--------	--------	--------	-------	--------	--------	--------	--------	--------

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

1524.01

 (45)

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

(46)m=

23.7	20.73	21.39	18.65	17.89	15.44	14.31	16.42	16.62	19.36	21.14	22.95
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (46)

Water storage loss:

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

190

 (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):

1.61

 (48)

Temperature factor from Table 2b

0.6

 (49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

 (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

$$(47) \times (51) \times (52) \times (53) =$$

0

 (54)

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

0.97

 (55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1876.6
---	--------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

76.49	67.59	71.37	64.52	63.62	57.41	55.67	60.35	60.01	66.88	70.04	74.84
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92	131.92

 (66)

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

(67)m=

21.47	19.07	15.51	11.74	8.78	7.41	8.01	10.41	13.97	17.73	20.7	22.06
-------	-------	-------	-------	------	------	------	-------	-------	-------	------	-------

 (67)

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

(68)m=

240.8	243.3	237	223.59	206.67	190.77	180.14	177.65	183.94	197.35	214.27	230.17
-------	-------	-----	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19	36.19
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53	-105.53
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

102.81	100.58	95.93	89.61	85.51	79.74	74.83	81.12	83.35	89.89	97.27	100.59
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

 (72)

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

(73)m=

427.65	425.51	411.01	387.52	363.54	340.49	325.56	331.75	343.84	367.55	394.81	415.4
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	11.49	x	10.63	x	0.4	x	1	=	33.87	(74)
North	0.9x	0.77	x	2.43	x	10.63	x	0.4	x	0.7	=	5.01	(74)
North	0.9x	0.77	x	11.49	x	20.32	x	0.4	x	1	=	64.72	(74)
North	0.9x	0.77	x	2.43	x	20.32	x	0.4	x	0.7	=	9.58	(74)
North	0.9x	0.77	x	11.49	x	34.53	x	0.4	x	1	=	109.98	(74)
North	0.9x	0.77	x	2.43	x	34.53	x	0.4	x	0.7	=	16.28	(74)
North	0.9x	0.77	x	11.49	x	55.46	x	0.4	x	1	=	176.66	(74)
North	0.9x	0.77	x	2.43	x	55.46	x	0.4	x	0.7	=	26.15	(74)
North	0.9x	0.77	x	11.49	x	74.72	x	0.4	x	1	=	237.97	(74)
North	0.9x	0.77	x	2.43	x	74.72	x	0.4	x	0.7	=	35.23	(74)
North	0.9x	0.77	x	11.49	x	79.99	x	0.4	x	1	=	254.76	(74)
North	0.9x	0.77	x	2.43	x	79.99	x	0.4	x	0.7	=	37.71	(74)
North	0.9x	0.77	x	11.49	x	74.68	x	0.4	x	1	=	237.85	(74)
North	0.9x	0.77	x	2.43	x	74.68	x	0.4	x	0.7	=	35.21	(74)
North	0.9x	0.77	x	11.49	x	59.25	x	0.4	x	1	=	188.7	(74)
North	0.9x	0.77	x	2.43	x	59.25	x	0.4	x	0.7	=	27.94	(74)
North	0.9x	0.77	x	11.49	x	41.52	x	0.4	x	1	=	132.23	(74)
North	0.9x	0.77	x	2.43	x	41.52	x	0.4	x	0.7	=	19.58	(74)
North	0.9x	0.77	x	11.49	x	24.19	x	0.4	x	1	=	77.04	(74)
North	0.9x	0.77	x	2.43	x	24.19	x	0.4	x	0.7	=	11.41	(74)
North	0.9x	0.77	x	11.49	x	13.12	x	0.4	x	1	=	41.78	(74)
North	0.9x	0.77	x	2.43	x	13.12	x	0.4	x	0.7	=	6.19	(74)
North	0.9x	0.77	x	11.49	x	8.86	x	0.4	x	1	=	28.23	(74)
North	0.9x	0.77	x	2.43	x	8.86	x	0.4	x	0.7	=	4.18	(74)
Northeast	0.9x	0.77	x	21.27	x	11.28	x	0.4	x	0.8	=	53.22	(75)
Northeast	0.9x	0.77	x	21.27	x	22.97	x	0.4	x	0.8	=	108.33	(75)
Northeast	0.9x	0.77	x	21.27	x	41.38	x	0.4	x	0.8	=	195.18	(75)
Northeast	0.9x	0.77	x	21.27	x	67.96	x	0.4	x	0.8	=	320.54	(75)
Northeast	0.9x	0.77	x	21.27	x	91.35	x	0.4	x	0.8	=	430.86	(75)
Northeast	0.9x	0.77	x	21.27	x	97.38	x	0.4	x	0.8	=	459.35	(75)
Northeast	0.9x	0.77	x	21.27	x	91.1	x	0.4	x	0.8	=	429.71	(75)
Northeast	0.9x	0.77	x	21.27	x	72.63	x	0.4	x	0.8	=	342.57	(75)
Northeast	0.9x	0.77	x	21.27	x	50.42	x	0.4	x	0.8	=	237.83	(75)
Northeast	0.9x	0.77	x	21.27	x	28.07	x	0.4	x	0.8	=	132.39	(75)
Northeast	0.9x	0.77	x	21.27	x	14.2	x	0.4	x	0.8	=	66.96	(75)
Northeast	0.9x	0.77	x	21.27	x	9.21	x	0.4	x	0.8	=	43.46	(75)
East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	129.07	254.95	440.53	697.03	916.93	969.72	910.22	737.4	528.14	306.65	161.02	106.28	(83)
--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	------

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

(84)m=	556.72	680.46	851.54	1084.56	1280.46	1310.21	1235.77	1069.15	871.98	674.19	555.84	521.67	(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=	0.96	0.93	0.85	0.69	0.51	0.35	0.26	0.31	0.54	0.82	0.94	0.97	(86)

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

(87)m=	19.31	19.63	20.13	20.65	20.89	20.98	20.99	20.99	20.91	20.49	19.82	19.27	(87)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(88)m=	20.2	20.2	20.21	20.23	20.23	20.25	20.25	20.26	20.24	20.23	20.22	20.21	(88)
--------	------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.95	0.92	0.84	0.67	0.47	0.31	0.21	0.26	0.49	0.79	0.93	0.96	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	17.91	18.38	19.08	19.8	20.12	20.23	20.25	20.25	20.16	19.61	18.67	17.87	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.47 (91)

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

(92)m=	18.56	18.97	19.57	20.2	20.48	20.58	20.6	20.6	20.51	20.03	19.21	18.53	(92)
--------	-------	-------	-------	------	-------	-------	------	------	-------	-------	-------	-------	------

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

(93)m=	18.56	18.97	19.57	20.2	20.48	20.58	20.6	20.6	20.51	20.03	19.21	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=	0.94	0.9	0.82	0.67	0.48	0.33	0.23	0.28	0.51	0.78	0.91	0.95	(94)
--------	------	-----	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	523.82	614.33	700.07	721.51	619.66	428.44	289.6	300.76	441.56	527.53	506.38	495.2	(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=	1119.9	1098.48	1014.97	852.85	659.14	436.14	291.48	304.12	472.87	707.58	919.32	1100.32	(97)
--------	--------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	443.48	325.35	234.28	94.56	29.37	0	0	0	0	133.96	297.32	450.21	
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DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 2008.53 (98)

Space heating requirement in kWh/m²/year

22.09 (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 0 685.45 539.61 550.92 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.97 0.98 0.97 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 662.02 528.46 533.65 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1622.66 1533.84 1340.41 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 x (98)m

(104)m = 0 0 0 0 0 691.66 748 600.23 0 0 0 0

Total = Sum(104) = 2039.9 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.81 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 140.38 151.82 121.83 0 0 0 0

Total = Sum(107) = 414.02 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 4.55 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

443.48	325.35	234.28	94.56	29.37	0	0	0	0	133.96	297.32	450.21
--------	--------	--------	-------	-------	---	---	---	---	--------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

260.87	191.38	137.81	55.62	17.28	0	0	0	0	78.8	174.89	264.83
--------	--------	--------	-------	-------	---	---	---	---	------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 1181.49 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

187.95	165.24	172.55	153.31	149.24	131.92	125.34	139.41	139.75	159.04	169.89	182.97
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1876.6 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	25.06	27.1	21.74	0	0	0	0
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Total = Sum(221)_{6..8} = 73.9 (221)

Annual totals

Space heating fuel used, main system 1

1181.49

Water heating fuel used

1876.6

Space cooling fuel used

73.9

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

295.81 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 295.81 (231)

Electricity for lighting

379.12 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3806.91 (238)

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	0.519	613.19 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	973.95 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1587.15 (265)
Space cooling	(221) x	0.519	38.35 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	153.53 (267)
Electricity for lighting	(232) x	0.519	196.76 (268)
Total CO2, kg/year		sum of (265)...(271) =	1975.79 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.73 (273)
EI rating (section 14)			81 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 02

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: South
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 324.11 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 370.46 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (NE)	0	1
East (E)	0	1
North (N)	0	1
North (N GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (NE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
North (N)	1	0.9	1	0.9	(P8)
North (N GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North East (NE)	0.9 x 21.27	89.66	0.4	0.8	0.9	494.29
East (E)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
North (N)	0.9 x 11.49	73.49	0.4	1	0.9	273.59
North (N GLAZED DOOR)	0.9 x 2.43	73.49	0.4	0.7	0.9	40.5
Total						1047.01 (P3/P4)

Internal gains:

	June	July	August
Internal gains	489.23	469.95	478.51
Total summer gains	1639.66	1516.96	1312.96 (P5)
Summer gain/loss ratio	4.43	4.09	3.54 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.43	21.79	21.14 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:19

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.81m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 03

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

22.25 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

21.14 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

38.9 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

34.3 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.86 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Slight	OK
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Based on:

Overshading:	Average or unknown
Windows facing: North East	21.16m ²
Windows facing: East	8.52m ²
Windows facing: South	1.57m ²
Windows facing: South	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

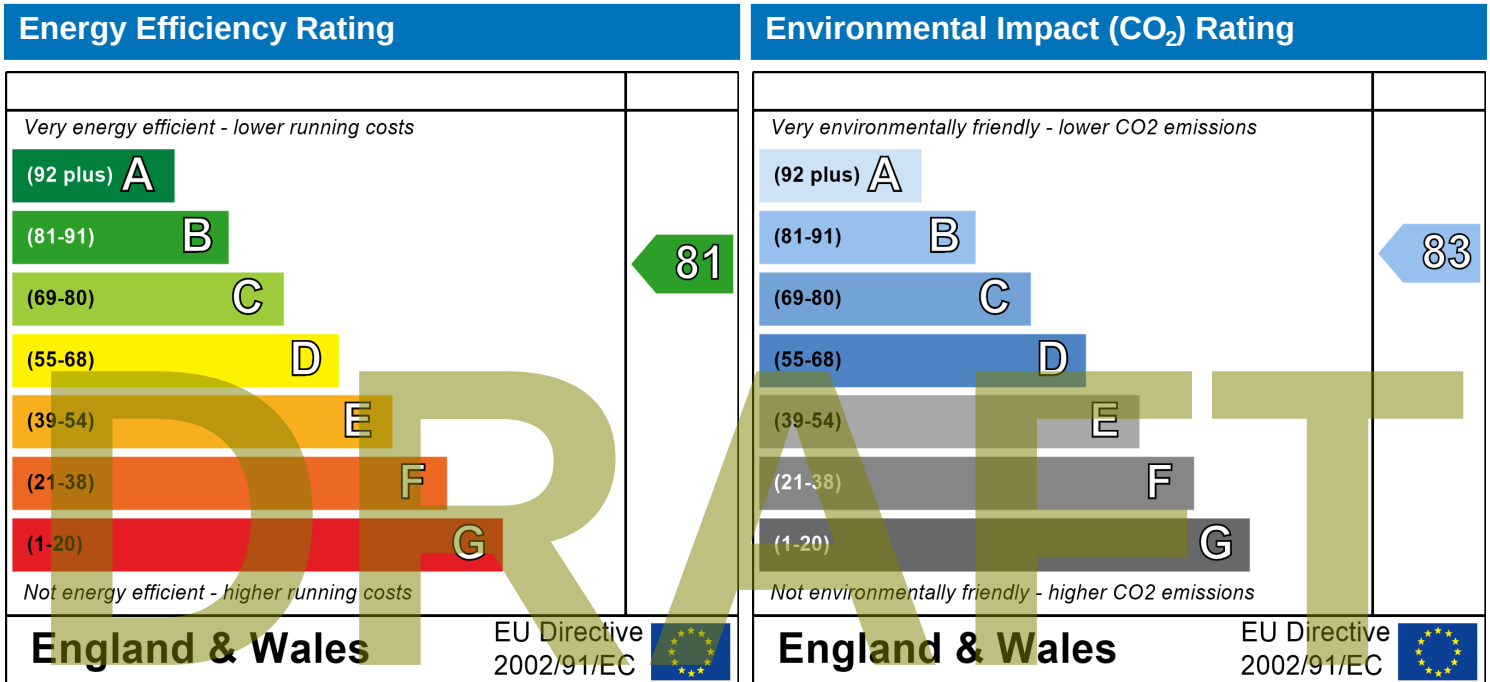
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.81 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.81 (1a) x	2.7 (2a) =	218.19 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
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SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.16	x 1/[1/(1) + 0.04]	20.35		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.26	33.81	7.45	x 0.24	1.79		(29)
Total area of elements, m²			41.26				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.88	x 0	0		(32)
Party floor			80.81				(32a)
Party ceiling			80.81				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.65 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
------	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

93.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.64

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01
-------	--------	-----	--------	-------	-------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1464.1

(45)

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

(46)m=

22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.69
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68	148.68

 (66)

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

(67)m=

49.28	43.77	35.6	26.95	20.15	17.01	18.38	23.89	32.06	40.71	47.52	50.65
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

330.04	333.46	324.83	306.46	283.27	261.47	246.91	243.48	252.11	270.49	293.68	315.48
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35	52.35
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

 (72)

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

(73)m=

581.27	577.03	555.76	522.67	488.74	458.25	440.35	448.47	467.43	500.73	537.82	565.93
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	724.17	846.9	990.26	1162.23	1291.52	1291.67	1228.8	1110.63	972.77	817.07	713.92	684.97	(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=	0.89	0.84	0.74	0.58	0.43	0.29	0.21	0.24	0.42	0.67	0.84	0.9	(86)

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

(87)m=	19.93	20.2	20.53	20.82	20.95	20.99	21	21	20.97	20.77	20.33	19.89	(87)
--------	-------	------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.88	0.82	0.72	0.56	0.4	0.26	0.18	0.21	0.38	0.64	0.82	0.89	(89)
--------	------	------	------	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.83	19.21	19.67	20.08	20.23	20.3	20.31	20.31	20.27	20.02	19.42	18.8	(90)
--------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(92)
--------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.4	19.72	20.12	20.46	20.6	20.66	20.66	20.67	20.63	20.41	19.89	19.37	(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=	0.87	0.81	0.72	0.56	0.41	0.28	0.2	0.23	0.39	0.65	0.81	0.88	(94)
--------	------	------	------	------	------	------	-----	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	627.49	686.47	708.75	655.44	530.08	358.46	241.89	251.96	383.95	527.51	580.16	602.46	(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=	969.48	946.5	864.69	714.3	546.91	361.46	242.55	253.02	394.26	602.41	794.49	952.58	(97)
--------	--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	-------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1070.63 (98)

Space heating requirement in kWh/m²/year

13.25 (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 0 560.93 441.58 450.87 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 548.01 435.81 442.29 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1432.38 1361.92 1222.42 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 x (98)m

(104)m = 0 0 0 0 0 636.74 689.03 580.41 0 0 0 0

Total = Sum(104) = 1906.19 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 135.29 146.4 123.32 0 0 0 0

Total = Sum(107) = 405.01 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.01 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

254.44	174.74	116.02	42.38	12.52	0	0	0	0	55.72	154.32	260.5
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	-------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

149.67	102.79	68.25	24.93	7.36	0	0	0	0	32.78	90.78	153.23
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 629.78 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.15	26.13	22.01	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 72.29 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

629.78

Water heating fuel used

1816.69

Space cooling fuel used

72.29

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.93 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.93 (231)

Electricity for lighting

348.15 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3089.84 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	83.07 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.62 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	9.54 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.4 (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 =	45.92 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		407.55 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.36	(257)
SAP rating (Section 12)		81.02	(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	0.519	=	326.86	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.86	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1269.72	(265)
Space cooling	(221) x	0.519	=	37.52	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.7	(267)
Electricity for lighting	(232) x	0.519	=	180.69	(268)
Total CO2, kg/year		sum of (265)...(271) =		1603.63	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.84	(273)
El rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1933.43	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5577.23	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7510.66	(265)
Space cooling	(221) x	3.07	=	221.94	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	684.4	(267)
Electricity for lighting	(232) x	0	=	1068.81	(268)
'Total Primary Energy		sum of (265)...(271) =		9485.81	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		117.38	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 03

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.81 (1a)	2.7 (2a)	218.19 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.81 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	218.19 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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	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 (15)
---------------------	--------

Infiltration rate	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)	0.25 (18)
--	-----------

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

Number of sides sheltered	3 (19)
---------------------------	--------

Shelter factor	0.78 (20)
----------------	-----------

Infiltration rate incorporating shelter factor	0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.16	x 1/[1/(1) + 0.04]	20.35		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.26	33.81	7.45	x 0.24	1.79		(29)
Total area of elements, m²			41.26				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.88	x 0	0		(32)
Party floor			80.81				(32a)
Party ceiling			80.81				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.3 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16875.84 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.65 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.55	26.2	25.86	24.11	23.76	22.02	22.02	21.67	22.72	23.76	24.46	25.16

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.21	63.86	63.51	61.77	61.42	59.67	59.67	59.32	60.37	61.42	62.11	62.81
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.79	0.79	0.79	0.76	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
------	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

93.05

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.36	98.64	94.91	91.19	87.47	83.75	83.75	87.47	91.19	94.91	98.64	102.36
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.64

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.8	132.76	137	119.44	114.6	98.89	91.64	105.16	106.41	124.02	135.37	147.01
-------	--------	-----	--------	-------	-------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1464.1

(45)

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

(46)m=

22.77	19.91	20.55	17.92	17.19	14.83	13.75	15.77	15.96	18.6	20.31	22.05
-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.69
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.43	65.78	69.51	62.9	62.06	56.07	54.43	58.92	58.57	65.19	68.2	72.84
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9	123.9

 (66)

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

(67)m=

19.71	17.51	14.24	10.78	8.06	6.8	7.35	9.56	12.83	16.28	19.01	20.26
-------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

221.13	223.42	217.64	205.33	189.79	175.18	165.43	163.13	168.92	181.23	196.76	211.37
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39	35.39
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12	-99.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.04	97.89	93.43	87.36	83.42	77.87	73.15	79.2	81.34	87.62	94.72	97.9
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 (72)

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

(73)m=

401.05	398.99	385.47	363.64	341.44	320.03	306.1	312.06	323.25	345.3	370.66	389.7
--------	--------	--------	--------	--------	--------	-------	--------	--------	-------	--------	-------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.77	x	21.16	x	11.28	x	0.4	x	0.8	=	52.94	(75)
Northeast	0.9x	0.77	x	21.16	x	22.97	x	0.4	x	0.8	=	107.77	(75)
Northeast	0.9x	0.77	x	21.16	x	41.38	x	0.4	x	0.8	=	194.17	(75)
Northeast	0.9x	0.77	x	21.16	x	67.96	x	0.4	x	0.8	=	318.88	(75)
Northeast	0.9x	0.77	x	21.16	x	91.35	x	0.4	x	0.8	=	428.64	(75)
Northeast	0.9x	0.77	x	21.16	x	97.38	x	0.4	x	0.8	=	456.97	(75)
Northeast	0.9x	0.77	x	21.16	x	91.1	x	0.4	x	0.8	=	427.49	(75)
Northeast	0.9x	0.77	x	21.16	x	72.63	x	0.4	x	0.8	=	340.8	(75)
Northeast	0.9x	0.77	x	21.16	x	50.42	x	0.4	x	0.8	=	236.6	(75)
Northeast	0.9x	0.77	x	21.16	x	28.07	x	0.4	x	0.8	=	131.7	(75)
Northeast	0.9x	0.77	x	21.16	x	14.2	x	0.4	x	0.8	=	66.62	(75)
Northeast	0.9x	0.77	x	21.16	x	9.21	x	0.4	x	0.8	=	43.24	(75)
East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	142.9	269.87	434.5	639.55	802.79	833.42	788.46	662.15	505.35	316.34	176.1	119.03	(83)
--------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------	------

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

(84)m=	543.95	668.86	819.97	1003.19	1144.22	1153.44	1094.56	974.21	828.6	661.64	546.76	508.73	(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=	0.95	0.9	0.81	0.65	0.48	0.33	0.24	0.28	0.48	0.76	0.91	0.95	(86)

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

(87)m=	19.59	19.93	20.36	20.76	20.93	20.99	21	20.99	20.95	20.65	20.07	19.55	(87)
--------	-------	-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.27	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.94	0.89	0.79	0.62	0.44	0.29	0.2	0.24	0.44	0.73	0.9	0.95	(89)
--------	------	------	------	------	------	------	-----	------	------	------	-----	------	------

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

(90)m=	18.36	18.84	19.44	19.99	20.21	20.29	20.3	20.31	20.25	19.87	19.06	18.31	(90)
--------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19	19.4	19.92	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.96	(92)
--------	----	------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19	19.4	19.92	20.39	20.58	20.65	20.66	20.66	20.61	20.28	19.58	18.96	(93)
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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=	0.93	0.88	0.78	0.63	0.46	0.31	0.22	0.26	0.46	0.73	0.89	0.94	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	503.46	586.14	643.67	628.56	522.36	356.98	241.53	251.3	377.15	483.96	484.41	476.22	(95)
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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=	943.87	926.11	852.02	709.55	545.63	361.23	242.49	252.92	393.16	594.42	775.42	926.91	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	327.66	228.46	155.02	58.31	17.31	0	0	0	0	82.18	209.53	335.32	
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DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1413.8 (98)

Space heating requirement in kWh/m²/year

17.5 (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 0 560.93 441.58 450.87 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.98 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 548.01 435.81 442.29 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1432.38 1361.92 1222.42 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 x (98)m

(104)m = 0 0 0 0 0 636.74 689.03 580.41 0 0 0 0

Total = Sum(104) = 1906.19 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 135.29 146.4 123.32 0 0 0 0

Total = Sum(107) = 405.01 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.01 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

327.66	228.46	155.02	58.31	17.31	0	0	0	0	82.18	209.53	335.32
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

192.74	134.39	91.19	34.3	10.19	0	0	0	0	48.34	123.25	197.25
--------	--------	-------	------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 831.64 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
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Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.74	159.81	166.94	148.42	144.55	127.87	121.59	135.1	135.39	153.96	164.35	176.95
--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.69 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	24.15	26.13	22.01	0	0	0	0
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Total = Sum(221)_{6..8} = 72.29 (221)

Annual totals

Space heating fuel used, main system 1

831.64 kWh/year

Water heating fuel used

1816.69 kWh/year

Space cooling fuel used

72.29 kWh/year

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.93 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.93 (231)

Electricity for lighting

348.15 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3291.7 (238)

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	0.519	431.62 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	942.86 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1374.48 (265)
Space cooling	(221) x	0.519	37.52 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.7 (267)
Electricity for lighting	(232) x	0.519	180.69 (268)
Total CO2, kg/year		sum of (265)...(271) =	1708.39 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	21.14 (273)
EI rating (section 14)			82 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 03

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: West
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 288.01 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 325.66 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
North East (NE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
North East (NE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
North East (NE)	0.9 x 21.16	89.66	0.4	0.8	0.9	491.73
East (E)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
South (S)	0.9 x 1.57	106.3	0.4	1	0.9	54.07
South (S GLAZED DOOR)	0.9 x 2.56	106.3	0.4	0.7	0.9	61.72
					Total	906.94 (P3/P4)

Internal gains:

	June	July	August
Internal gains	458.25	440.35	448.47
Total summer gains	1446.99	1347.29	1197.77 (P5)
Summer gain/loss ratio	4.44	4.14	3.68 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.44	21.84	21.28 (P7)
Likelihood of high internal temperature	Not significant	Slight	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Slight

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:11

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.72m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 04

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

20.38 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

20.10 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.8 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

30.4 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (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

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: South East	21.25m ²
Windows facing: East	8.52m ²
Windows facing: South	1.57m ²
Windows facing: South	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

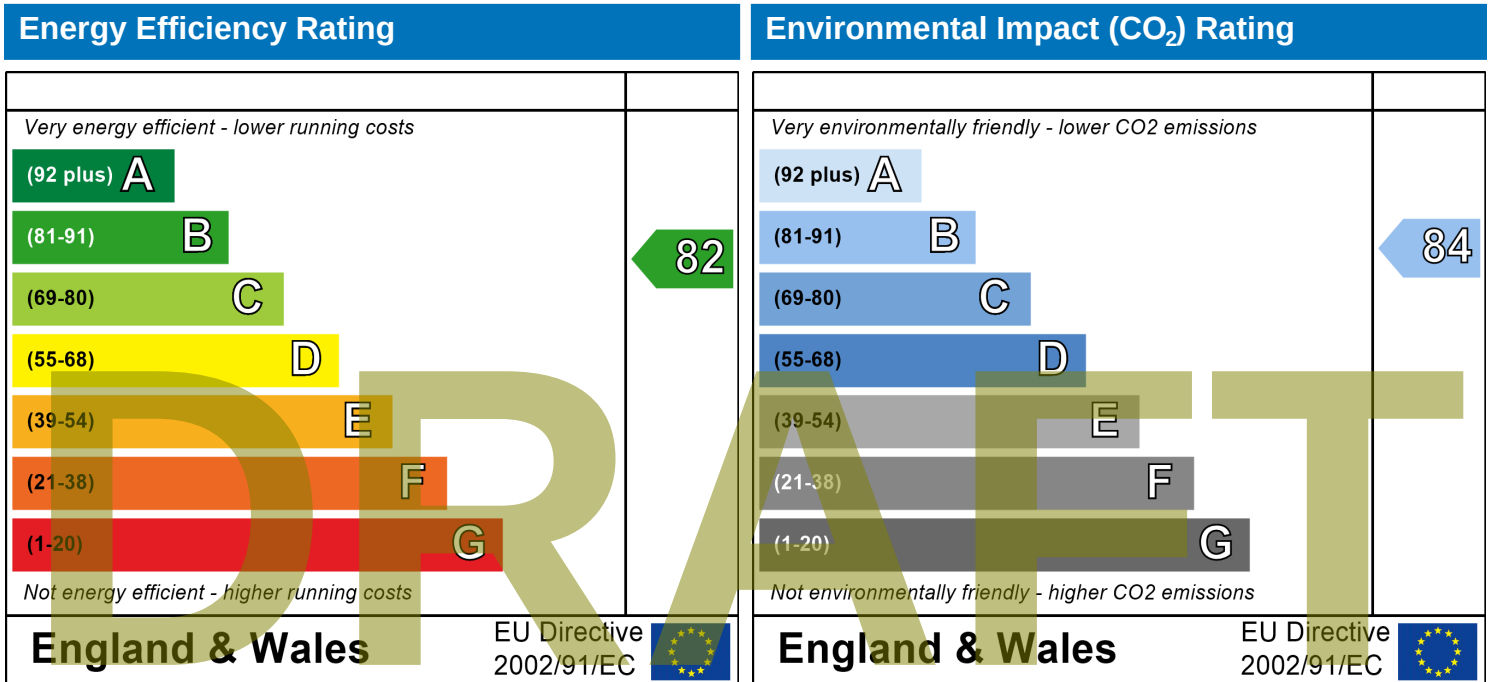
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.72 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.72 (1a) ×	2.7 (2a) =	217.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	217.94 (5)

2. Ventilation rate:

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

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 ÷ (5) = 0 (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]×0.1 = 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 × (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 × (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) × (20) = 0.19 (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
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SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.9	7.2	x 0.24	1.73		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.5	x 0	0		(32)
Party wall			29.89	x 0	0		(32)
Party floor			80.71				(32a)
Party ceiling			80.72				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.68 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13	(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=	64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81	
Average = Sum(39) _{1...12} /12=												61.68	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	
Average = Sum(40) _{1...12} /12=												0.76	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	
(44)m=	102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32	
Total = Sum(44) _{1...12} =												1116.17	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94	
Total = Sum(45) _{1...12} =												1463.47	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04	(46)

Water storage loss:

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

	190	(47)
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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):

	1.61	(48)
--	------	------

Temperature factor from Table 2b

	0.6	(49)
--	-----	------

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

	0.97	(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

$$(47) \times (51) \times (52) \times (53) =$$

	0	(54)
--	---	------

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

	0.97	(55)
--	------	------

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
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 (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)

Output from water heater

(64)m=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1816.06
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 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58	148.58

 (66)

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

(67)m=

49.24	43.74	35.57	26.93	20.13	16.99	18.36	23.87	32.04	40.68	47.48	50.61
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 (67)

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

(68)m=

329.76	333.18	324.56	306.2	283.03	261.25	246.7	243.28	251.9	270.26	293.43	315.21
--------	--------	--------	-------	--------	--------	-------	--------	-------	--------	--------	--------

 (68)

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

(69)m=

52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33	52.33
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (70)

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

(71)m=

-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87
--------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

580.87	576.64	555.39	522.32	488.41	457.96	440.06	448.18	467.12	500.4	537.46	565.55
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 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
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SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)
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Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	844.22	1034.08	1199.82	1343.7	1423.39	1391.17	1337.82	1261.47	1173.43	1011.45	854.62	789.73	(84)
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7. Mean internal temperature (heating season)

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

21 (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=	0.85	0.77	0.66	0.52	0.39	0.27	0.2	0.22	0.35	0.58	0.78	0.87	(86)

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

(87)m=	20.11	20.41	20.67	20.88	20.96	20.99	21	21	20.98	20.86	20.49	20.06	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.49	0.36	0.24	0.17	0.18	0.31	0.54	0.76	0.86	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.08	19.5	19.86	20.14	20.25	20.3	20.3	20.31	20.28	20.12	19.64	19.03	(90)
--------	-------	------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.62	19.97	20.28	20.52	20.62	20.66	20.67	20.67	20.64	20.51	20.08	19.57	(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=	0.82	0.74	0.64	0.5	0.38	0.26	0.18	0.2	0.33	0.55	0.75	0.84	(94)
--------	------	------	------	-----	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	695.47	766.49	765.18	676.09	534.85	359.24	242.12	252.43	389.13	561.08	641.03	665.12	(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=	983.35	962.34	875.29	717.88	547.72	361.62	242.62	253.14	395.13	608.35	806.32	965.24	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29	
--------	--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------	--

SAP WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 844.86 (98)

Space heating requirement in kWh/m²/year

10.47 (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 0 560.95 441.6 450.89 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.66 437.2 445.17 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1548.73 1489.38 1398.78 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 x (98)m

(104)m = 0 0 0 0 0 718.61 782.83 709.48 0 0 0 0

Total = Sum(104) = 2210.92 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 153.52 167.24 151.57 0 0 0 0

Total = Sum(107) = 472.34 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.85 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

214.19	131.61	81.92	30.09	9.58	0	0	0	0	35.17	119.01	223.29
--------	--------	-------	-------	------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

125.99	77.42	48.19	17.7	5.63	0	0	0	0	20.69	70.01	131.35
--------	-------	-------	------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 496.97 (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)

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Water heating

Output from water heater (calculated above)

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1...12} = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	27.4	29.85	27.05	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6...8} = 84.31 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

496.97

Water heating fuel used

1816.06

Space cooling fuel used

84.31

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.68 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.68 (231)

Electricity for lighting

347.85 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

2967.88 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	65.55 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.54 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	11.12 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.37 (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 =	45.88 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		391.46 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.31	(257)
SAP rating (Section 12)		81.76	(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	0.519	=	257.93	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.54	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1200.47	(265)
Space cooling	(221) x	0.519	=	43.76	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.57	(267)
Electricity for lighting	(232) x	0.519	=	180.54	(268)
Total CO2, kg/year		sum of (265)...(271) =		1540.33	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.08	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1525.71	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5575.31	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7101.02	(265)
Space cooling	(221) x	3.07	=	258.83	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	683.64	(267)
Electricity for lighting	(232) x	0	=	1067.91	(268)
'Total Primary Energy		sum of (265)...(271) =		9111.4	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		112.88	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 04

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.72 (1a)	2.7 (2a)	217.94 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.72 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	217.94 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.25	x 1/[1/(1) + 0.04]	20.43		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.9	7.2	x 0.24	1.73		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.5	x 0	0		(32)
Party wall			29.89	x 0	0		(32)
Party floor			80.71				(32a)
Party ceiling			80.72				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.32 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16855.94 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.68 (37)

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Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
26.52	26.17	25.83	24.08	23.74	21.99	21.99	21.65	22.69	23.74	24.43	25.13

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

64.2	63.86	63.51	61.77	61.42	59.68	59.68	59.33	60.37	61.42	62.11	62.81
------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

61.68

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78
-----	------	------	------	------	------	------	------	------	------	------	------

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.76

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.48

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d, \text{average}} = (25 \times N) + 36$

93.01

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

102.32	98.59	94.87	91.15	87.43	83.71	83.71	87.43	91.15	94.87	98.59	102.32
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1116.17

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

151.73	132.7	136.94	119.39	114.55	98.85	91.6	105.11	106.37	123.96	135.31	146.94
--------	-------	--------	--------	--------	-------	------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1463.47

(45)

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

(46)m=

22.76	19.91	20.54	17.91	17.18	14.83	13.74	15.77	15.96	18.59	20.3	22.04
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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(56)

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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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.06
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.76	69.49	62.88	62.05	56.05	54.41	58.91	58.55	65.17	68.18	72.82
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82	123.82

 (66)

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

(67)m=

19.7	17.49	14.23	10.77	8.05	6.8	7.34	9.55	12.81	16.27	18.99	20.24
------	-------	-------	-------	------	-----	------	------	-------	-------	-------	-------

 (67)

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

(68)m=

220.94	223.23	217.45	205.15	189.63	175.04	165.29	163	168.77	181.07	196.6	211.19
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	-------	--------

 (68)

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

(69)m=

35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06	-99.06
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.01	97.86	93.4	87.33	83.4	77.85	73.14	79.18	81.32	87.6	94.69	97.87
--------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------

 (72)

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

(73)m=

400.79	398.73	385.23	363.41	341.22	319.83	305.92	311.86	323.05	345.09	370.42	389.45
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(76)
East	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(76)
East	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(76)
East	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(76)
East	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(76)
East	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(76)
East	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(76)
East	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(76)
East	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(76)
East	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(76)
East	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(76)
East	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(76)
Southeast	0.9x	0.77	x	21.25	x	36.79	x	0.4	x	0.8	=	173.39	(77)
Southeast	0.9x	0.77	x	21.25	x	62.67	x	0.4	x	0.8	=	295.34	(77)
Southeast	0.9x	0.77	x	21.25	x	85.75	x	0.4	x	0.8	=	404.1	(77)
Southeast	0.9x	0.77	x	21.25	x	106.25	x	0.4	x	0.8	=	500.7	(77)
Southeast	0.9x	0.77	x	21.25	x	119.01	x	0.4	x	0.8	=	560.83	(77)
Southeast	0.9x	0.77	x	21.25	x	118.15	x	0.4	x	0.8	=	556.77	(77)
Southeast	0.9x	0.77	x	21.25	x	113.91	x	0.4	x	0.8	=	536.79	(77)
Southeast	0.9x	0.77	x	21.25	x	104.39	x	0.4	x	0.8	=	491.93	(77)
Southeast	0.9x	0.77	x	21.25	x	92.85	x	0.4	x	0.8	=	437.56	(77)
Southeast	0.9x	0.77	x	21.25	x	69.27	x	0.4	x	0.8	=	326.42	(77)
Southeast	0.9x	0.77	x	21.25	x	44.07	x	0.4	x	0.8	=	207.68	(77)
Southeast	0.9x	0.77	x	21.25	x	31.49	x	0.4	x	0.8	=	148.38	(77)
South	0.9x	0.77	x	1.57	x	46.75	x	0.4	x	1	=	20.35	(78)
South	0.9x	0.77	x	2.56	x	46.75	x	0.4	x	0.7	=	23.22	(78)
South	0.9x	0.77	x	1.57	x	76.57	x	0.4	x	1	=	33.32	(78)
South	0.9x	0.77	x	2.56	x	76.57	x	0.4	x	0.7	=	38.03	(78)
South	0.9x	0.77	x	1.57	x	97.53	x	0.4	x	1	=	42.45	(78)
South	0.9x	0.77	x	2.56	x	97.53	x	0.4	x	0.7	=	48.45	(78)
South	0.9x	0.77	x	1.57	x	110.23	x	0.4	x	1	=	47.97	(78)
South	0.9x	0.77	x	2.56	x	110.23	x	0.4	x	0.7	=	54.76	(78)
South	0.9x	0.77	x	1.57	x	114.87	x	0.4	x	1	=	49.99	(78)
South	0.9x	0.77	x	2.56	x	114.87	x	0.4	x	0.7	=	57.06	(78)
South	0.9x	0.77	x	1.57	x	110.55	x	0.4	x	1	=	48.11	(78)
South	0.9x	0.77	x	2.56	x	110.55	x	0.4	x	0.7	=	54.91	(78)
South	0.9x	0.77	x	1.57	x	108.01	x	0.4	x	1	=	47.01	(78)
South	0.9x	0.77	x	2.56	x	108.01	x	0.4	x	0.7	=	53.65	(78)
South	0.9x	0.77	x	1.57	x	104.89	x	0.4	x	1	=	45.65	(78)
South	0.9x	0.77	x	2.56	x	104.89	x	0.4	x	0.7	=	52.11	(78)
South	0.9x	0.77	x	1.57	x	101.89	x	0.4	x	1	=	44.34	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.56	x	101.89	x	0.4	x	0.7	=	50.61	(78)
South	0.9x	0.77	x	1.57	x	82.59	x	0.4	x	1	=	35.94	(78)
South	0.9x	0.77	x	2.56	x	82.59	x	0.4	x	0.7	=	41.02	(78)
South	0.9x	0.77	x	1.57	x	55.42	x	0.4	x	1	=	24.12	(78)
South	0.9x	0.77	x	2.56	x	55.42	x	0.4	x	0.7	=	27.53	(78)
South	0.9x	0.77	x	1.57	x	40.4	x	0.4	x	1	=	17.58	(78)
South	0.9x	0.77	x	2.56	x	40.4	x	0.4	x	0.7	=	20.07	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	263.34	457.44	644.43	821.37	934.98	933.22	897.75	813.29	706.31	511.05	317.16	224.18	(83)
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	664.13	856.17	1029.66	1184.78	1276.2	1253.05	1203.67	1125.15	1029.36	856.14	687.58	613.63	(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=	0.91	0.83	0.73	0.58	0.43	0.3	0.22	0.24	0.39	0.65	0.85	0.93	(86)

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

(87)m=	19.82	20.21	20.56	20.83	20.95	20.99	21	21	20.97	20.79	20.29	19.76	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.9	0.82	0.7	0.55	0.4	0.27	0.18	0.21	0.36	0.62	0.84	0.92	(89)
--------	-----	------	-----	------	-----	------	------	------	------	------	------	------	------

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

(90)m=	18.68	19.23	19.71	20.08	20.23	20.3	20.3	20.31	20.27	20.04	19.37	18.61	(90)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.28	19.74	20.15	20.47	20.6	20.66	20.67	20.67	20.64	20.43	19.85	19.21	(92)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.28	19.74	20.15	20.47	20.6	20.66	20.67	20.67	20.64	20.43	19.85	19.21	(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=	0.89	0.81	0.7	0.56	0.41	0.29	0.2	0.22	0.37	0.63	0.82	0.9	(94)
--------	------	------	-----	------	------	------	-----	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	589.06	690.89	721.01	658.43	529.4	358.14	241.88	252.05	385.8	535.73	566.76	554.43	(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=	961.55	947.38	867.03	714.85	546.83	361.45	242.58	253.08	394.6	603.91	791.87	942.83	(97)
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	277.13	172.37	108.64	40.62	12.97	0	0	0	0	50.72	162.08	288.97	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1113.5 (98)

Space heating requirement in kWh/m²/year

13.79 (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 0 560.95 441.6 450.89 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.66 437.2 445.17 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1548.73 1489.38 1398.78 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 x (98)m

(104)m = 0 0 0 0 0 718.61 782.83 709.48 0 0 0 0

Total = Sum(104) = 2210.92 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 153.52 167.24 151.57 0 0 0 0

Total = Sum(107) = 472.34 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.85 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

277.13	172.37	108.64	40.62	12.97	0	0	0	0	50.72	162.08	288.97
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

163.02	101.39	63.91	23.89	7.63	0	0	0	0	29.84	95.34	169.98
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 655 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.68	159.75	166.89	148.37	144.5	127.83	121.55	135.06	135.35	153.91	164.29	176.89
--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------	--------

Total = Sum(219a)_{1..12} = 1816.06 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	27.4	29.85	27.05	0	0	0	0
---	---	---	---	---	------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 84.31 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

655

Water heating fuel used

1816.06

Space cooling fuel used

84.31

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.68 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.68 (231)

Electricity for lighting

347.85 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3125.91 (238)

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	0.519	339.94 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	942.54 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1282.48 (265)
Space cooling	(221) x	0.519	43.76 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.57 (267)
Electricity for lighting	(232) x	0.519	180.54 (268)
Total CO2, kg/year		sum of (265)...(271) =	1622.35 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	20.1 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 04

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: West
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 287.69 (P1)
Transmission heat loss coefficient: 37.7
Summer heat loss coefficient: 325.37 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South East (SE)	0.9 x 21.25	112.1	0.4	0.8	0.9	617.45
East (E)	0.9 x 8.52	108.47	0.4	1	0.9	299.43
South (S)	0.9 x 1.57	106.3	0.4	1	0.9	54.07
South (S GLAZED DOOR)	0.9 x 2.56	106.3	0.4	0.7	0.9	61.72
Total						1032.67 (P3/P4)

Internal gains:

	June	July	August
Internal gains	457.96	440.06	448.18
Total summer gains	1565.09	1472.73	1368.5 (P5)
Summer gain/loss ratio	4.81	4.53	4.21 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.81	22.23	21.81 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:46:03

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.5m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 05

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

18.79 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

18.66 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

29.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: South East	21.4m ²
Windows facing: East	6.79m ²
Windows facing: South	11.46m ²
Windows facing: South	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

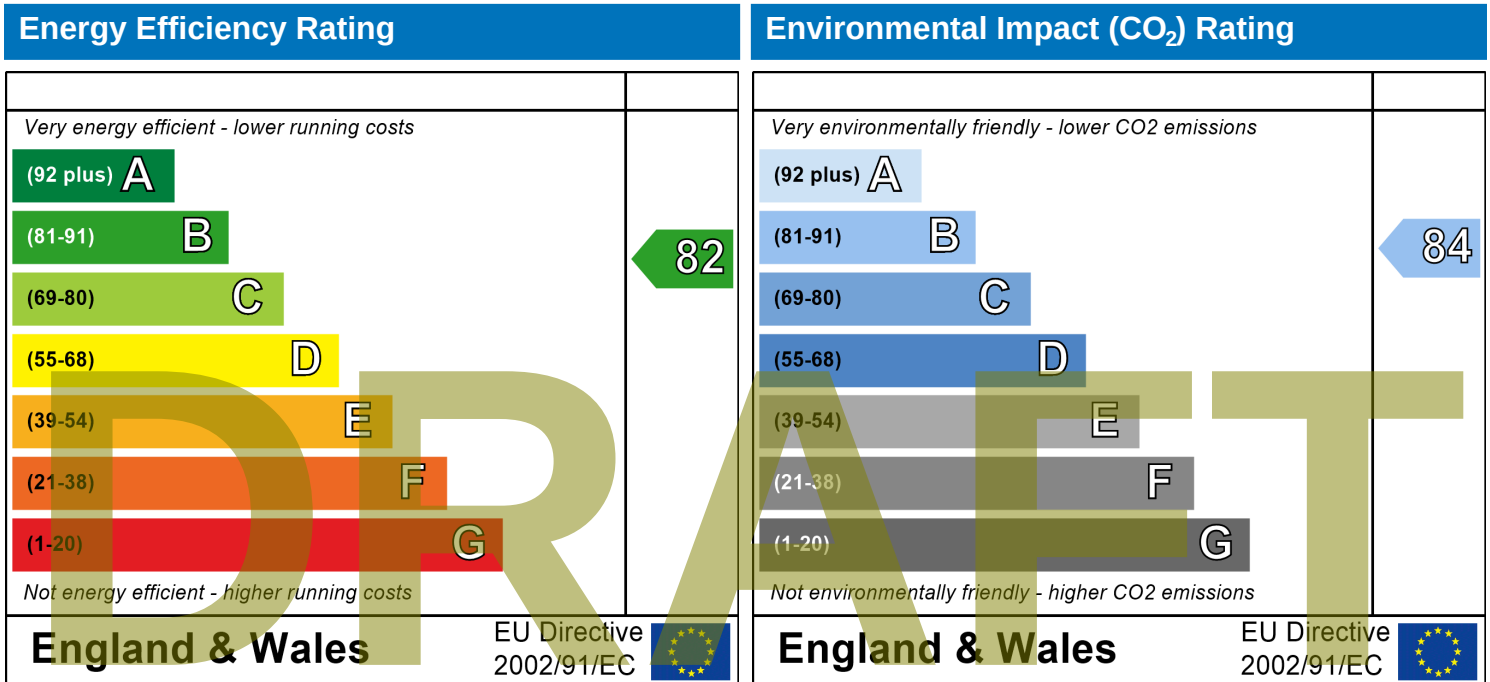
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
99.5 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.5 (1a)	2.7 (2a)	268.65 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.65 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.4	x 1/[1/(1) + 0.04]	20.58		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.4	42.08	8.32	x 0.24	2		(29)
Total area of elements, m²			50.4				(31)
Party wall			70.09	x 0	0		(32)
Party wall			7.3	x 0	0		(32)
Party floor			99.5				(32a)
Party ceiling			99.5				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.41 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72
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$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

78.19

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8
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$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.79

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.73

(42)

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

99.15

(43)

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

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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Hot water usage in litres per day for each month $V_{d,m} = \text{factor from Table 1c} \times (43)$

(44)m=

109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07
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$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1189.83

(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=

161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64
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$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1560.06

(45)

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

(46)m=

24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5
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(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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
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 (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
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 (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=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
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 (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
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 (63)

Output from water heater

(64)m=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
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Output from water heater (annual) ^{1...12}	1912.65
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 (64)

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

(65)m=

77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09	164.09

 (66)

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

(67)m=

56.95	50.58	41.14	31.14	23.28	19.65	21.24	27.6	37.05	47.04	54.91	58.53
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 (67)

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

(68)m=

381.37	385.33	375.35	354.12	327.32	302.14	285.31	281.35	291.32	312.55	339.35	364.54
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 (68)

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

(69)m=

54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14
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 (69)

Pumps and fans gains (Table 5a)

(70)m=

0	0	0	0	0	0	0	0	0	0	0	0
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 (70)

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

(71)m=

-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39
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 (71)

Water heating gains (Table 5)

(72)m=

104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2
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 (72)

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

(73)m=

651.64	646.94	622.77	585.08	546.22	511.49	491.22	500.07	521.78	559.69	601.91	634.12
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 (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)
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SAP WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

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South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)
--------	--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

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

(84)m=	1033.78	1296.02	1504.64	1665.16	1742.94	1693.4	1633.3	1556.35	1472.63	1275.51	1059.32	961.33	(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=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

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

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(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=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	857.33	960.32	960.81	848.47	672.25	451.39	303.83	316.76	489.48	705.63	798.06	815.83	(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=	1239.55	1216.22	1106.62	906.28	691.09	455.01	304.6	317.81	497.69	767.68	1016.39	1214.58	(97)
--------	---------	---------	---------	--------	--------	--------	-------	--------	--------	--------	---------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	-------	--------	--

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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1120.49 (98)

Space heating requirement in kWh/m²/year

11.26 (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 0 709.5 558.55 570.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 694.16 551.93 561.83 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1892.94 1826.12 1734.68 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 x (98)m

(104)m = 0 0 0 0 0 863.12 948 872.6 0 0 0 0

Total = Sum(104) = 2683.72 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.83 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 179.98 197.67 181.95 0 0 0 0

Total = Sum(107) = 559.6 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

284.37	171.96	108.48	41.62	14.02	0	0	0	0	46.17	157.2	296.67
--------	--------	--------	-------	-------	---	---	---	---	-------	-------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

167.28	101.15	63.81	24.48	8.25	0	0	0	0	27.16	92.47	174.51
--------	--------	-------	-------	------	---	---	---	---	-------	-------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12}= 659.11 (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)

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Water heating

Output from water heater (calculated above)

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

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

1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.12	35.28	32.48	0	0	0	0
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Total = Sum(221)_{6..8} =

99.88 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

659.11

Water heating fuel used

1912.65

Space cooling fuel used

99.88

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.66

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

323.66

(231)

Electricity for lighting

402.29

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3397.59

(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.94 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.28 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.17 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.69 (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 =	53.06 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		448.14 (255)

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11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.3	(257)
SAP rating (Section 12)		81.83	(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	0.519	=	342.08	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	992.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1334.74	(265)
Space cooling	(221) x	0.519	=	51.84	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	167.98	(267)
Electricity for lighting	(232) x	0.519	=	208.79	(268)
Total CO2, kg/year		sum of (265)...(271) =		1763.35	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.72	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2023.47	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5871.83	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7895.3	(265)
Space cooling	(221) x	3.07	=	306.65	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	993.62	(267)
Electricity for lighting	(232) x	0	=	1235.04	(268)
'Total Primary Energy		sum of (265)...(271) =		10430.61	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		104.83	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 05

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.5 (1a)	2.7 (2a)	268.65 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.5 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.65 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.4	x 1/[1/(1) + 0.04]	20.58		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.4	42.08	8.32	x 0.24	2		(29)
Total area of elements, m²			50.4				(31)
Party wall			70.09	x 0	0		(32)
Party wall			7.3	x 0	0		(32)
Party floor			99.5				(32a)
Party ceiling			99.5				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.46 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21017.7 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.41 (37)

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Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.19	34.72	34.25	31.89	31.42	29.07	29.07	28.6	30.01	31.42	32.36	33.31	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

	81.6	81.13	80.66	78.31	77.83	75.48	75.48	75.01	76.42	77.83	78.78	79.72	
(39)m=													
Average = Sum(39) _{1...12} /12=												78.19	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	0.82	0.82	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	
(40)m=													
Average = Sum(40) _{1...12} /12=												0.79	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													
(44)m=	109.07	105.1	101.14	97.17	93.2	89.24	89.24	93.2	97.17	101.14	105.1	109.07	
Total = Sum(44) _{1...12} =												1189.83	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	161.74	141.46	145.98	127.27	122.12	105.38	97.65	112.05	113.39	132.14	144.25	156.64	
(45)m=													
Total = Sum(45) _{1...12} =												1560.06	(45)

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

	24.26	21.22	21.9	19.09	18.32	15.81	14.65	16.81	17.01	19.82	21.64	23.5	
(46)m=													(46)

Water storage loss:

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

	190	(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):

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

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

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

If community heating see section 4.3

Volume factor from Table 2a

Temperature factor from Table 2b

Energy lost from water storage, kWh/year

$$(47) \times (51) \times (52) \times (53) =$$

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

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	
(56)m=													(56)

DER WorkSheet: New dwelling design stage

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=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1912.65
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.74	68.67	72.49	65.5	64.56	58.22	56.42	61.21	60.89	67.89	71.15	76.04
-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74	136.74

 (66)

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

(67)m=

22.78	20.23	16.45	12.46	9.31	7.86	8.49	11.04	14.82	18.82	21.96	23.41
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

255.52	258.17	251.49	237.26	219.31	202.43	191.16	188.51	195.19	209.41	227.37	244.24
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39	-109.39
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.49	102.19	97.44	90.97	86.77	80.86	75.84	82.28	84.56	91.26	98.81	102.2
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (72)

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

(73)m=

446.8	444.62	429.4	404.71	379.42	355.18	339.51	345.85	358.59	383.51	412.17	433.88
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(76)
East	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(76)
East	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(76)
East	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(76)
East	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(76)
East	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(76)
East	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(76)
East	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(76)
East	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(76)
East	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(76)
East	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(76)
East	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(76)
Southeast	0.9x	0.77	x	21.4	x	36.79	x	0.4	x	0.8	=	174.61	(77)
Southeast	0.9x	0.77	x	21.4	x	62.67	x	0.4	x	0.8	=	297.43	(77)
Southeast	0.9x	0.77	x	21.4	x	85.75	x	0.4	x	0.8	=	406.95	(77)
Southeast	0.9x	0.77	x	21.4	x	106.25	x	0.4	x	0.8	=	504.23	(77)
Southeast	0.9x	0.77	x	21.4	x	119.01	x	0.4	x	0.8	=	564.78	(77)
Southeast	0.9x	0.77	x	21.4	x	118.15	x	0.4	x	0.8	=	560.7	(77)
Southeast	0.9x	0.77	x	21.4	x	113.91	x	0.4	x	0.8	=	540.57	(77)
Southeast	0.9x	0.77	x	21.4	x	104.39	x	0.4	x	0.8	=	495.4	(77)
Southeast	0.9x	0.77	x	21.4	x	92.85	x	0.4	x	0.8	=	440.64	(77)
Southeast	0.9x	0.77	x	21.4	x	69.27	x	0.4	x	0.8	=	328.72	(77)
Southeast	0.9x	0.77	x	21.4	x	44.07	x	0.4	x	0.8	=	209.14	(77)
Southeast	0.9x	0.77	x	21.4	x	31.49	x	0.4	x	0.8	=	149.43	(77)
South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	382.14	649.08	881.87	1080.08	1196.72	1181.91	1142.08	1056.28	950.86	715.82	457.41	327.21	(83)
--------	--------	--------	--------	---------	---------	---------	---------	---------	--------	--------	--------	--------	------

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

(84)m=	828.94	1093.7	1311.27	1484.8	1576.14	1537.08	1481.59	1402.12	1309.45	1099.33	869.58	761.09	(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=	0.91	0.83	0.72	0.58	0.44	0.31	0.22	0.24	0.39	0.64	0.85	0.93	(86)

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

(87)m=	19.77	20.19	20.54	20.82	20.94	20.99	21	21	20.97	20.79	20.27	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.26	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.9	0.81	0.7	0.55	0.41	0.28	0.19	0.21	0.35	0.61	0.83	0.92	(89)
--------	-----	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.59	19.18	19.67	20.05	20.2	20.28	20.29	20.29	20.25	20.02	19.32	18.52	(90)
--------	-------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.17	19.67	20.1	20.43	20.56	20.63	20.63	20.64	20.6	20.4	19.78	19.1	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	------	------

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

(93)m=	19.17	19.67	20.1	20.43	20.56	20.63	20.63	20.64	20.6	20.4	19.78	19.1	(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=	0.89	0.8	0.69	0.56	0.42	0.29	0.2	0.23	0.37	0.62	0.82	0.9	(94)
--------	------	-----	------	------	------	------	-----	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	734.38	874.61	910.23	827.22	665.22	449.91	303.5	316.27	485.56	677.08	712.94	687.69	(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=	1213.45	1198.69	1096.85	902.51	689.9	454.78	304.55	317.73	497.05	762.53	999.27	1187.72	(97)
--------	---------	---------	---------	--------	-------	--------	--------	--------	--------	--------	--------	---------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	356.42	217.79	138.84	54.21	18.37	0	0	0	0	63.58	206.16	372.02	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1427.39 (98)

Space heating requirement in kWh/m²/year

14.35 (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 0 709.5 558.55 570.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 694.16 551.93 561.83 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1892.94 1826.12 1734.68 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 x (98)m

(104)m = 0 0 0 0 0 863.12 948 872.6 0 0 0 0

Total = Sum(104) = 2683.72 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.83 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 179.98 197.67 181.95 0 0 0 0

Total = Sum(107) = 559.6 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

356.42	217.79	138.84	54.21	18.37	0	0	0	0	63.58	206.16	372.02
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

209.66	128.11	81.67	31.89	10.8	0	0	0	0	37.4	121.27	218.84
--------	--------	-------	-------	------	---	---	---	---	------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 839.64 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.69	168.51	175.92	156.25	152.06	134.36	127.59	142	142.37	162.09	173.23	186.59
--------	--------	--------	--------	--------	--------	--------	-----	--------	--------	--------	--------

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

1912.65 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.12	35.28	32.48	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} =

99.88 (221)

Annual totals

Space heating fuel used, main system 1

839.64

Water heating fuel used

1912.65

Space cooling fuel used

99.88

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.66 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

323.66 (231)

Electricity for lighting

402.29 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3578.12 (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	0.519	435.77 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	992.66 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1428.44 (265)
Space cooling	(221) x	0.519	51.84 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	167.98 (267)
Electricity for lighting	(232) x	0.519	208.79 (268)
Total CO2, kg/year		sum of (265)...(271) =	1857.04 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.66 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 05

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: North
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 354.62 (P1)
Transmission heat loss coefficient: 46.4
Summer heat loss coefficient: 401.03 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South East (SE)	0	1
East (E)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South East (SE)	1	0.9	1	0.9	(P8)
East (E)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South East (SE)	0.9 x 21.4	112.1	0.4	0.8	0.9	621.81
East (E)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
South (S)	0.9 x 11.46	106.3	0.4	1	0.9	394.69
South (S GLAZED DOOR)	0.9 x 2.43	106.3	0.4	0.7	0.9	58.58
Total						1313.71 (P3/P4)

Internal gains:

	June	July	August
Internal gains	511.49	491.22	500.07
Total summer gains	1913.66	1804.93	1695.37 (P5)
Summer gain/loss ratio	4.77	4.5	4.23 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.77	22.2	21.83 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:45:55

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 99.42m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 06

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

18.79 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

18.67 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

32.6 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

29.6 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

Party wall

0.00 (max. 0.20)

-

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (max. 3.30)

OK

OK

OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.79	
Maximum	1.5	OK
MVHR efficiency:	88%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
-----------------------------------	--------	----

Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m ²
Windows facing: West	6.79m ²
Windows facing: South	11.46m ²
Windows facing: South	2.43m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

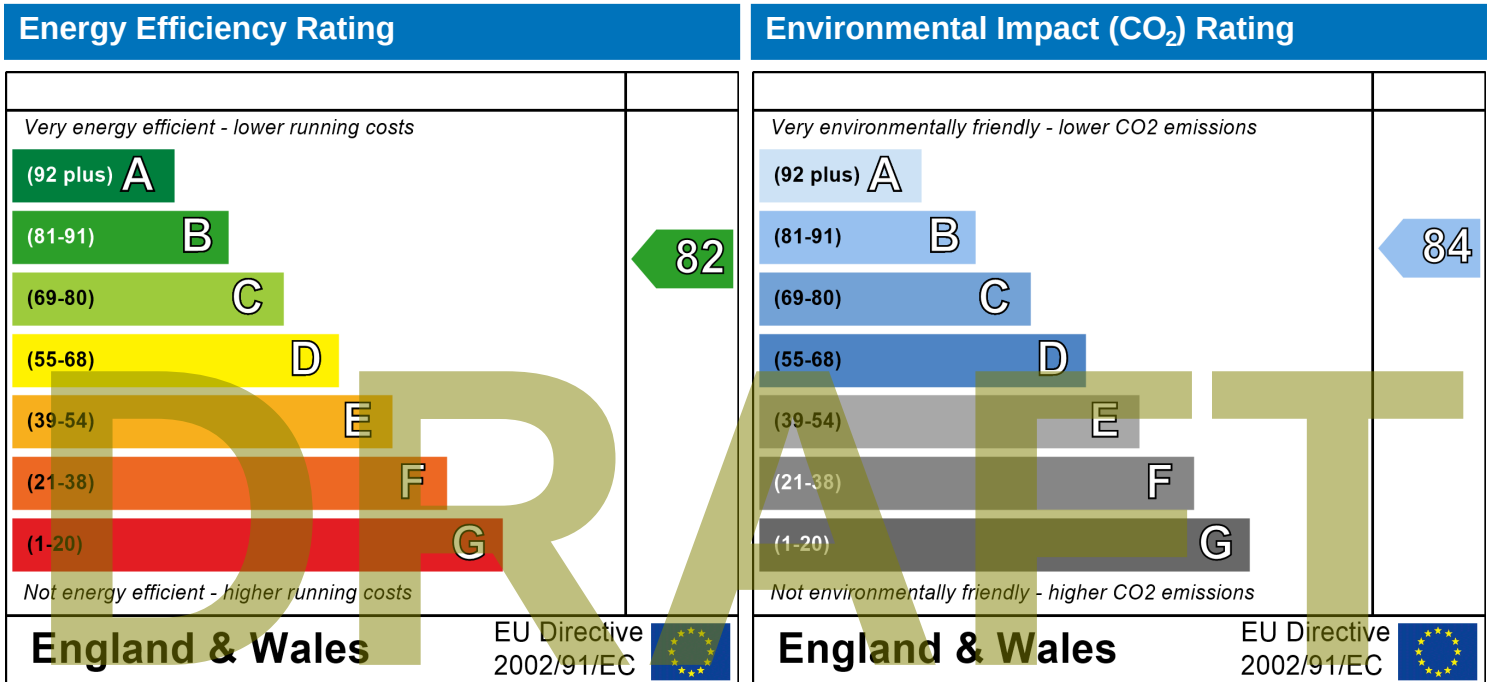
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
99.42 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 06

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.42 (1a) x	2.7 (2a) =	268.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (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
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SAP WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
------	------	------	------	------	-----	-----	-----	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.39	41.95	8.44	x 0.24	2.03		(29)
Total area of elements, m²			50.39				(31)
Party wall			62.33	x 0	0		(32)
Party wall			15.01	x 0	0		(32)
Party floor			99.42				(32a)
Party ceiling			99.42				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.31 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28	(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=	81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59	
Average = Sum(39) _{1...12} /12=												78.06	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8	
Average = Sum(40) _{1...12} /12=												0.79	(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

$$\text{if TFA} > 13.9, N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$$

$$\text{if TFA} \leq 13.9, N = 1$$

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													

(44)m=	109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05	
Total = Sum(44) _{1...12} =												1189.62	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61	
Total = Sum(45) _{1...12} =												1559.77	(45)

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

(46)m=	24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49	(46)
--------	-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------	------

Water storage loss:

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

	190	(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):

	1.61	(48)
--	------	------

Temperature factor from Table 2b

	0.6	(49)
--	-----	------

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

	0.97	(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

$$(47) \times (51) \times (52) \times (53) =$$

	0	(54)
--	---	------

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

	0.97	(55)
--	------	------

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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)

Output from water heater

(64)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual) ^{1...12}	1912.36
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05	164.05

 (66)

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

(67)m=

56.92	50.56	41.11	31.13	23.27	19.64	21.23	27.59	37.03	47.02	54.88	58.5
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

 (67)

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

(68)m=

381.17	385.13	375.16	353.94	327.16	301.98	285.16	281.21	291.18	312.39	339.18	364.36
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14	54.14
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	------	--------

 (72)

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

(73)m=

651.39	646.69	622.52	584.85	546.01	511.3	491.04	499.89	521.58	559.48	601.68	633.87
--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

SAP WorkSheet: New dwelling design stage

South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

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West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)
--------	--------	--------	-------	---------	---------	--------	---------	---------	--------	--------	--------	-------	------

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

(84)m=	1032.47	1293.96	1501.92	1661.87	1739.3	1689.8	1629.83	1553.15	1469.76	1273.3	1057.82	960.17	(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=	0.86	0.77	0.66	0.53	0.4	0.28	0.2	0.22	0.35	0.58	0.78	0.88	(86)

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

(87)m=	20.04	20.37	20.65	20.86	20.95	20.99	21	21	20.98	20.85	20.45	19.99	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.84	0.75	0.64	0.5	0.37	0.25	0.17	0.19	0.32	0.54	0.76	0.86	(89)
--------	------	------	------	-----	------	------	------	------	------	------	------	------	------

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

(90)m=	18.97	19.43	19.81	20.1	20.22	20.28	20.29	20.29	20.26	20.09	19.57	18.91	(90)
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	----	-------	------

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

(93)m=	19.49	19.89	20.22	20.47	20.58	20.63	20.64	20.64	20.61	20.46	20	19.44	(93)
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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=	0.83	0.74	0.64	0.51	0.39	0.27	0.19	0.2	0.33	0.55	0.75	0.85	(94)
--------	------	------	------	------	------	------	------	-----	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	856.28	958.96	959.38	847.18	671.23	450.7	303.37	316.28	488.74	704.59	797	814.87	(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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	1237.77	1214.42	1104.96	904.9	690.03	454.31	304.14	317.32	496.93	766.52	1014.88	1212.82	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1118.38 (98)

Space heating requirement in kWh/m²/year

11.25 (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 0 708.37 557.66 569.15 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 693.06 551.06 560.94 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1888.77 1822.1 1730.98 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 x (98)m

(104)m = 0 0 0 0 0 860.91 945.66 870.51 0 0 0 0

Total = Sum(104) = 2677.08 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.84 (105)

Intermittency factor (Table 10b)

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

Total = Sum(106) = 0 (106)

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

(107)m = 0 0 0 0 0 180.35 198.11 182.36 0 0 0 0

Total = Sum(107) = 560.82 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.64 (108)

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) x [1 – (203)] = 1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

283.83	171.66	108.31	41.56	13.99	0	0	0	0	46.07	156.88	296.08
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

166.96	100.98	63.71	24.45	8.23	0	0	0	0	27.1	92.28	174.16
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Total (kWh/year) =Sum(211)_{1...5,10...12} = 657.87 (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)

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Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
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Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Total = Sum(219a)_{1..12} = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0
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Total = Sum(221)_{6..8} = 100.1 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

kWh/year

657.87

Water heating fuel used

1912.36

Space cooling fuel used

100.1

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.4

(230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

323.4

(231)

Electricity for lighting

402.09

(232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3395.82

(338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	86.77 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	252.24 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	13.2 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	42.66 (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 =	53.04 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		447.91 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.3	(257)
SAP rating (Section 12)		81.83	(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	0.519	=	341.44	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	992.52	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1333.95	(265)
Space cooling	(221) x	0.519	=	51.95	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	167.84	(267)
Electricity for lighting	(232) x	0.519	=	208.68	(268)
Total CO2, kg/year		sum of (265)...(271) =		1762.43	(272)
CO2 emissions per m²		(272) ÷ (4) =		17.73	(273)
El rating (section 14)				84	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	2019.67	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5870.96	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7890.63	(265)
Space cooling	(221) x	3.07	=	307.31	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	992.83	(267)
Electricity for lighting	(232) x	0	=	1234.41	(268)
'Total Primary Energy		sum of (265)...(271) =		10425.18	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		104.86	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 06

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	99.42 (1a)	2.7 (2a)	268.43 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	99.42 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	268.43 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	0	0	0	0 (6a)
Number of open flues	0	0	0	0	0 (6b)
Number of intermittent fans				0	0 (7a)
Number of passive vents				0	0 (7b)
Number of flueless gas fires				0	0 (7c)

	Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0 (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) 0.25 (18)

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

Number of sides sheltered 2 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.85 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.21 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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DER WorkSheet: New dwelling design stage

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

0.27	0.27	0.26	0.23	0.23	0.2	0.2	0.2	0.21	0.23	0.24	0.25
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Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

74.8 (23c)

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

(24a)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.4 0.39 0.39 0.36 0.35 0.33 0.33 0.32 0.34 0.35 0.37 0.38 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			6.79	x 1/[1/(1) + 0.04]	6.53		(27)
Windows Type 3			11.46	x 1/[1/(1) + 0.04]	11.02		(27)
Windows Type 4			2.43	x 1/[1/(1) + 0.04]	2.34		(27)
Walls	50.39	41.95	8.44	x 0.24	2.03		(29)
Total area of elements, m²			50.39				(31)
Party wall			62.33	x 0	0		(32)
Party wall			15.01	x 0	0		(32)
Party floor			99.42				(32a)
Party ceiling			99.42				(32b)
Internal wall **			160.38				(32c)

* 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) = 42.36 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 21003.98 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.95 (36)

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

Total fabric heat loss (33) + (36) = 46.31 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

(38)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
35.16	34.69	34.22	31.87	31.4	29.04	29.04	28.57	29.99	31.4	32.34	33.28

(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=

81.48	81.01	80.54	78.18	77.71	75.36	75.36	74.89	76.3	77.71	78.65	79.59
-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------

$$\text{Average} = \text{Sum}(39)_{1...12} / 12 =$$

78.06

(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=

0.82	0.81	0.81	0.79	0.78	0.76	0.76	0.75	0.77	0.78	0.79	0.8
------	------	------	------	------	------	------	------	------	------	------	-----

$$\text{Average} = \text{Sum}(40)_{1...12} / 12 =$$

0.79

(40)

Number of days in month (Table 1a)

(41)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
31	28	31	30	31	30	31	31	30	31	30	31

(41)

4. Water heating energy requirement:

kWh/year:

Assumed occupancy, N

2.73

(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

99.13

(43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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=

109.05	105.08	101.12	97.15	93.19	89.22	89.22	93.19	97.15	101.12	105.08	109.05
--------	--------	--------	-------	-------	-------	-------	-------	-------	--------	--------	--------

$$\text{Total} = \text{Sum}(44)_{1...12} =$$

1189.62

(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=

161.72	141.44	145.95	127.24	122.09	105.36	97.63	112.03	113.37	132.12	144.22	156.61
--------	--------	--------	--------	--------	--------	-------	--------	--------	--------	--------	--------

$$\text{Total} = \text{Sum}(45)_{1...12} =$$

1559.77

(45)

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

(46)m=

24.26	21.22	21.89	19.09	18.31	15.8	14.64	16.8	17.01	19.82	21.63	23.49
-------	-------	-------	-------	-------	------	-------	------	-------	-------	-------	-------

(46)

Water storage loss:

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

190

(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):

1.61

(48)

Temperature factor from Table 2b

0.6

(49)

Energy lost from water storage, kWh/year

$$(48) \times (49) =$$

0.97

(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

$$(47) \times (51) \times (52) \times (53) =$$

0

(54)

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

0.97

(55)

Water storage loss calculated for each month

$$((56)m = (55) \times (41)m$$

(56)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

(56)

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

 (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)

Output from water heater

(64)m=

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Output from water heater (annual) ^{1...12}	1912.36
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

77.73	68.67	72.49	65.49	64.55	58.22	56.42	61.21	60.88	67.89	71.14	76.03
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7	136.7

 (66)

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

(67)m=

22.77	20.22	16.45	12.45	9.31	7.86	8.49	11.04	14.81	18.81	21.95	23.4
-------	-------	-------	-------	------	------	------	-------	-------	-------	-------	------

 (67)

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

(68)m=

255.39	258.04	251.36	237.14	219.19	202.33	191.06	188.41	195.09	209.3	227.25	244.12
--------	--------	--------	--------	--------	--------	--------	--------	--------	-------	--------	--------

 (68)

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

(69)m=

36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67	36.67
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36	-109.36
---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------	---------

 (71)

Water heating gains (Table 5)

(72)m=

104.47	102.18	97.43	90.96	86.76	80.85	75.83	82.27	84.55	91.25	98.8	102.19
--------	--------	-------	-------	-------	-------	-------	-------	-------	-------	------	--------

 (72)

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

(73)m=

446.64	444.45	429.24	404.57	379.28	355.05	339.39	345.72	358.47	383.37	412.01	433.72
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

South	0.9x	0.77	x	11.46	x	46.75	x	0.4	x	1	=	148.52	(78)
South	0.9x	0.77	x	2.43	x	46.75	x	0.4	x	0.7	=	22.04	(78)
South	0.9x	0.77	x	11.46	x	76.57	x	0.4	x	1	=	243.23	(78)
South	0.9x	0.77	x	2.43	x	76.57	x	0.4	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	11.46	x	97.53	x	0.4	x	1	=	309.84	(78)
South	0.9x	0.77	x	2.43	x	97.53	x	0.4	x	0.7	=	45.99	(78)
South	0.9x	0.77	x	11.46	x	110.23	x	0.4	x	1	=	350.18	(78)
South	0.9x	0.77	x	2.43	x	110.23	x	0.4	x	0.7	=	51.98	(78)
South	0.9x	0.77	x	11.46	x	114.87	x	0.4	x	1	=	364.91	(78)
South	0.9x	0.77	x	2.43	x	114.87	x	0.4	x	0.7	=	54.16	(78)
South	0.9x	0.77	x	11.46	x	110.55	x	0.4	x	1	=	351.18	(78)
South	0.9x	0.77	x	2.43	x	110.55	x	0.4	x	0.7	=	52.13	(78)
South	0.9x	0.77	x	11.46	x	108.01	x	0.4	x	1	=	343.12	(78)
South	0.9x	0.77	x	2.43	x	108.01	x	0.4	x	0.7	=	50.93	(78)
South	0.9x	0.77	x	11.46	x	104.89	x	0.4	x	1	=	333.22	(78)
South	0.9x	0.77	x	2.43	x	104.89	x	0.4	x	0.7	=	49.46	(78)
South	0.9x	0.77	x	11.46	x	101.89	x	0.4	x	1	=	323.66	(78)
South	0.9x	0.77	x	2.43	x	101.89	x	0.4	x	0.7	=	48.04	(78)
South	0.9x	0.77	x	11.46	x	82.59	x	0.4	x	1	=	262.35	(78)
South	0.9x	0.77	x	2.43	x	82.59	x	0.4	x	0.7	=	38.94	(78)
South	0.9x	0.77	x	11.46	x	55.42	x	0.4	x	1	=	176.04	(78)
South	0.9x	0.77	x	2.43	x	55.42	x	0.4	x	0.7	=	26.13	(78)
South	0.9x	0.77	x	11.46	x	40.4	x	0.4	x	1	=	128.33	(78)
South	0.9x	0.77	x	2.43	x	40.4	x	0.4	x	0.7	=	19.05	(78)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	6.79	x	19.64	x	0.4	x	1	=	36.97	(80)
West	0.9x	0.77	x	6.79	x	38.42	x	0.4	x	1	=	72.31	(80)
West	0.9x	0.77	x	6.79	x	63.27	x	0.4	x	1	=	119.09	(80)
West	0.9x	0.77	x	6.79	x	92.28	x	0.4	x	1	=	173.69	(80)
West	0.9x	0.77	x	6.79	x	113.09	x	0.4	x	1	=	212.86	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	6.79	x	115.77	x	0.4	x	1	=	217.9	(80)
West	0.9x	0.77	x	6.79	x	110.22	x	0.4	x	1	=	207.45	(80)
West	0.9x	0.77	x	6.79	x	94.68	x	0.4	x	1	=	178.2	(80)
West	0.9x	0.77	x	6.79	x	73.59	x	0.4	x	1	=	138.51	(80)
West	0.9x	0.77	x	6.79	x	45.59	x	0.4	x	1	=	85.81	(80)
West	0.9x	0.77	x	6.79	x	24.49	x	0.4	x	1	=	46.09	(80)
West	0.9x	0.77	x	6.79	x	16.15	x	0.4	x	1	=	30.4	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	381.08	647.27	879.4	1077.02	1193.29	1178.5	1138.79	1053.27	948.18	713.82	456.14	326.3	(83)
--------	--------	--------	-------	---------	---------	--------	---------	---------	--------	--------	--------	-------	------

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

(84)m=	827.72	1091.72	1308.64	1481.59	1572.57	1533.55	1478.19	1398.99	1306.64	1097.19	868.16	760.03	(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=	0.91	0.83	0.72	0.58	0.44	0.31	0.22	0.24	0.39	0.64	0.85	0.93	(86)

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

(87)m=	19.77	20.19	20.54	20.82	20.94	20.99	21	21	20.97	20.79	20.27	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.24	20.24	20.24	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.26	20.25	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(89)m=	0.9	0.81	0.7	0.55	0.41	0.28	0.19	0.21	0.35	0.61	0.83	0.92	(89)
--------	-----	------	-----	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.6	19.18	19.67	20.05	20.2	20.28	20.29	20.29	20.25	20.02	19.32	18.52	(90)
--------	------	-------	-------	-------	------	-------	-------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.49 (91)

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

(92)m=	19.17	19.68	20.1	20.43	20.56	20.63	20.64	20.64	20.6	20.4	19.79	19.1	(92)
--------	-------	-------	------	-------	-------	-------	-------	-------	------	------	-------	------	------

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

(93)m=	19.17	19.68	20.1	20.43	20.56	20.63	20.64	20.64	20.6	20.4	19.79	19.1	(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=	0.89	0.8	0.69	0.56	0.42	0.29	0.21	0.23	0.37	0.62	0.82	0.9	(94)
--------	------	-----	------	------	------	------	------	------	------	------	------	-----	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	733.38	873.25	908.78	825.91	664.19	449.22	303.04	315.79	484.82	676.04	711.9	686.79	(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=	1211.69	1196.91	1095.19	901.12	688.85	454.08	304.09	317.25	496.29	761.37	997.78	1186	(97)
--------	---------	---------	---------	--------	--------	--------	--------	--------	--------	--------	--------	------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	355.86	217.49	138.68	54.15	18.35	0	0	0	0	63.49	205.83	371.41	
--------	--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------	--

DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1425.27 (98)

Space heating requirement in kWh/m²/year

14.34 (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 0 708.37 557.66 569.15 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 693.06 551.06 560.94 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1888.77 1822.1 1730.98 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 x (98)m

(104)m = 0 0 0 0 0 860.91 945.66 870.51 0 0 0 0

Total = Sum(104) = 2677.08 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.84 (105)

Intermittency factor (Table 10b)

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

Total = Sum(106) = 0 (106)

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

(107)m = 0 0 0 0 0 180.35 198.11 182.36 0 0 0 0

Total = Sum(107) = 560.82 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.64 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

kWh/year

Space heating requirement (calculated above)

355.86	217.49	138.68	54.15	18.35	0	0	0	0	63.49	205.83	371.41
--------	--------	--------	-------	-------	---	---	---	---	-------	--------	--------

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

209.33	127.94	81.58	31.85	10.79	0	0	0	0	37.35	121.08	218.48
--------	--------	-------	-------	-------	---	---	---	---	-------	--------	--------

Total (kWh/year) =Sum(211)_{1...5,10...12} = 838.4 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

191.66	168.49	175.9	156.22	152.04	134.34	127.57	141.98	142.35	162.07	173.2	186.56
--------	--------	-------	--------	--------	--------	--------	--------	--------	--------	-------	--------

Total = Sum(219a)_{1..12} = 1912.36 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	32.19	35.36	32.55	0	0	0	0
---	---	---	---	---	-------	-------	-------	---	---	---	---

Total = Sum(221)_{6..8} = 100.1 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

838.4

Water heating fuel used

1912.36

Space cooling fuel used

100.1

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

323.4 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 323.4 (231)

Electricity for lighting

402.09 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3576.35 (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	0.519	435.13 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	992.52 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1427.64 (265)
Space cooling	(221) x	0.519	51.95 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	167.84 (267)
Electricity for lighting	(232) x	0.519	208.68 (268)
Total CO2, kg/year		sum of (265)...(271) =	1856.12 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	18.67 (273)
EI rating (section 14)			83 (274)

SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 19 June 2023

Property Details: Level 38 Flat 38 06

Dwelling type: Flat
Located in: England
Region: West Pennines
Cross ventilation possible: No
Number of storeys: 1
Front of dwelling faces: North
Overshading: Average or unknown
Overhangs: None
Thermal mass parameter: Indicative Value Low
Night ventilation: False
Blinds, curtains, shutters:
Ventilation rate during hot weather (ach): 4 (Windows fully open)

Overheating Details:

Summer ventilation heat loss coefficient: 354.33 (P1)
Transmission heat loss coefficient: 46.3
Summer heat loss coefficient: 400.65 (P2)

Overhangs:

Orientation:	Ratio:	Z_overhangs:
South West (SW)	0	1
West (W)	0	1
South (S)	0	1
South (S GLAZED DOOR)	0	1

Solar shading:

Orientation:	Z blinds:	Solar access:	Overhangs:	Z summer:	
South West (SW)	1	0.9	1	0.9	(P8)
West (W)	1	0.9	1	0.9	(P8)
South (S)	1	0.9	1	0.9	(P8)
South (S GLAZED DOOR)	1	0.9	1	0.9	(P8)

Solar gains:

Orientation	Area	Flux	g_	FF	Shading	Gains
South West (SW)	0.9 x 21.27	112.1	0.4	0.8	0.9	618.03
West (W)	0.9 x 6.79	108.47	0.4	1	0.9	238.63
South (S)	0.9 x 11.46	106.3	0.4	1	0.9	394.69
South (S GLAZED DOOR)	0.9 x 2.43	106.3	0.4	0.7	0.9	58.58
Total						1309.93 (P3/P4)

Internal gains:

	June	July	August
Internal gains	511.3	491.04	499.89
Total summer gains	1909.43	1800.97	1691.77 (P5)
Summer gain/loss ratio	4.77	4.5	4.22 (P6)
Mean summer external temperature (West Pennines)	14.7	16.4	16.3
Thermal mass temperature increment	1.3	1.3	1.3
Threshold temperature	20.77	22.2	21.82 (P7)
Likelihood of high internal temperature	Slight	Medium	Slight

SAP 2012 Overheating Assessment

Assessment of likelihood of high internal temperature: Medium

DRAFT

Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.5.60
Printed on 19 June 2023 at 15:45:48

Project Information:

Assessed By: ()

Building Type: Flat

Dwelling Details:

NEW DWELLING DESIGN STAGE

Total Floor Area: 80.75m²

Site Reference : P1785 St Michaels

Plot Reference: Level 38 Flat 38 07

Address :

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: Electricity

Fuel factor: 1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER)

20.85 kg/m²

Dwelling Carbon Dioxide Emission Rate (DER)

20.36 kg/m²

OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)

34.3 kWh/m²

Dwelling Fabric Energy Efficiency (DFEE)

31.4 kWh/m²

OK

2 Fabric U-values

Element

Average

Highest

External wall

0.00 (max. 0.30)

0.00 (max. 0.70)

OK

Party wall

0.00 (max. 0.20)

-

OK

Floor

(no floor)

Roof

(no roof)

Openings

0.87 (max. 2.00)

1.00 (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

5.00 (design value)

Maximum

10.0

OK

4 Heating efficiency

Main Heating system:

Heat pumps with warm air distribution - electric

Air source heat pump

Efficiency 170 %

Minimum 170 %

Secondary heating system:

None

5 Cylinder insulation

Hot water Storage:

Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG: 2.17 kWh/day

OK

Regulations Compliance Report

Primary pipework insulated: No primary pipework

6 Controls

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

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100.0%	
Minimum	75.0%	OK

8 Mechanical ventilation

Continuous supply and extract system		
Specific fan power:	0.67	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum	70%	OK

9 Summertime temperature

Overheating risk (West Pennines):	Medium	OK
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Based on:

Overshading:	Average or unknown
Windows facing: South West	21.27m ²
Windows facing: West	8.52m ²
Windows facing: North	1.57m ²
Windows facing: North	2.56m ²
Ventilation rate:	4.00

10 Key features

Windows U-value	1 W/m ² K
Party Walls U-value	0 W/m ² K
Fixed cooling system	

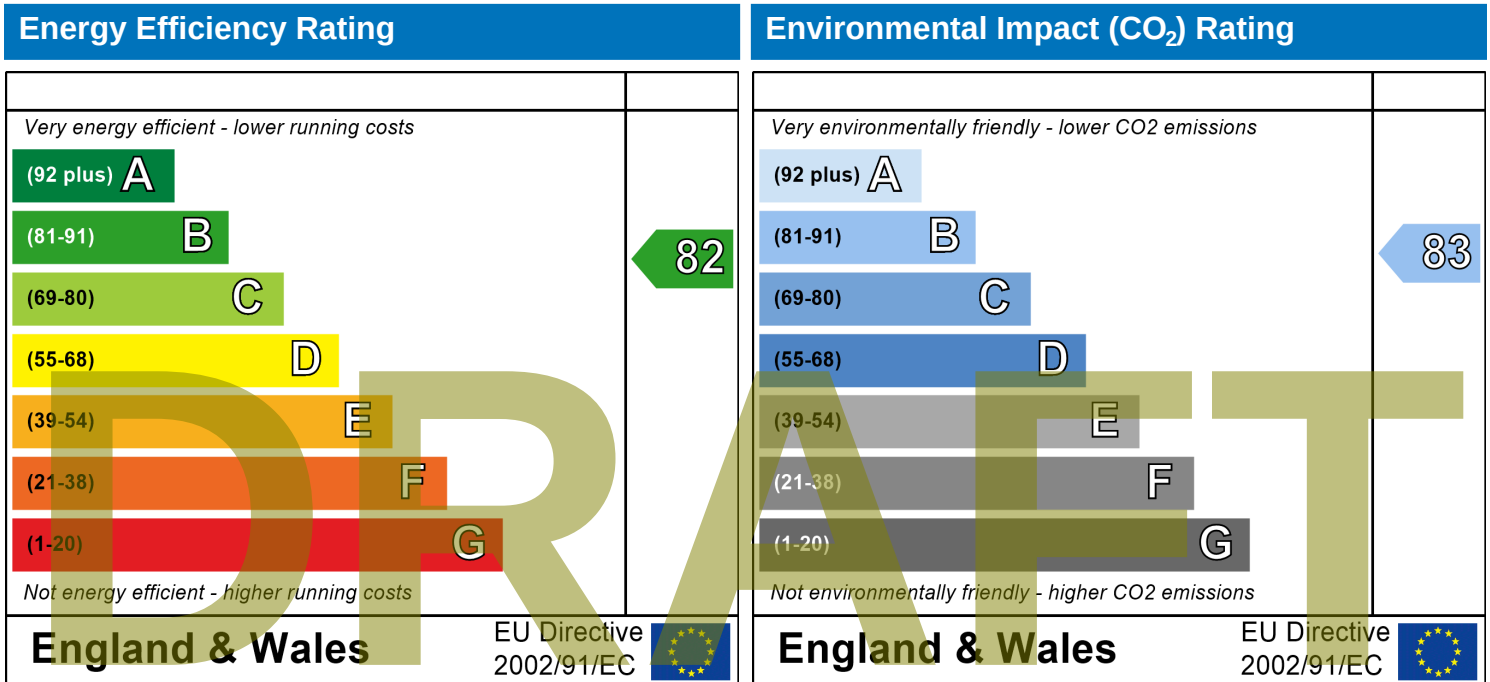
Predicted Energy Assessment

Dwelling type:
Date of assessment:
Produced by:
Total floor area:

Mid floor Flat
11 August 2022
Stroma Certification
80.75 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.



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 WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 07

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.75 (1a) x	2.7 (2a) =	218.03 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.03 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (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
---------	------	------	------	-----	------	------	------	------	---	------	------	------

SAP WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.92	7.18	x 0.24	1.72		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.95	x 0	0		(32)
Party floor			80.75				(32a)
Party ceiling			80.75				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.7 (37)

SAP WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(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=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	
Average = Sum(39) _{1...12} /12=												61.7	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	
Average = Sum(40) _{1...12} /12=												0.76	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$ 93.03 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	
(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	
Total = Sum(44) _{1...12} =												1116.33	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	
Total = Sum(45) _{1...12} =												1463.68	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 190 (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): 1.61 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year $(48) \times (49) =$ 0.97 (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 $(47) \times (51) \times (52) \times (53) =$ 0 (54)

Enter (50) or (54) in (55) 0.97 (55)

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)

SAP WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
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 (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=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) ^{1...12}	1816.27
---	---------

 (64)

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

(65)m=

74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82
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 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62	148.62

 (66)

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

(67)m=

49.26	43.75	35.58	26.94	20.13	17	18.37	23.87	32.04	40.69	47.49	50.62
-------	-------	-------	-------	-------	----	-------	-------	-------	-------	-------	-------

 (67)

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

(68)m=

329.85	333.27	324.65	306.29	283.11	261.32	246.77	243.35	251.97	270.33	293.51	315.3
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	-------

 (68)

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

(69)m=

52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34	52.34
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

581	576.77	555.51	522.44	488.52	458.05	440.16	448.28	467.22	500.51	537.58	565.68
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

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North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

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West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(86)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	810.85	982.07	1141.61	1293.24	1386.6	1363.31	1307.35	1219.49	1117.68	957.44	815.51	760.61	(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=	0.86	0.79	0.68	0.54	0.4	0.28	0.2	0.22	0.37	0.6	0.79	0.88	(86)

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

(87)m=	20.06	20.35	20.64	20.86	20.96	20.99	21	21	20.98	20.84	20.45	20.02	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
--------	-------	-------	-------	-------	-------	-------	-------	-------	------	-------	-------	-------	------

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

(89)m=	0.85	0.77	0.66	0.51	0.37	0.25	0.17	0.19	0.33	0.57	0.77	0.87	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	19.02	19.43	19.81	20.12	20.24	20.3	20.3	20.31	20.28	20.1	19.58	18.97	(90)
--------	-------	-------	-------	-------	-------	------	------	-------	-------	------	-------	-------	------

fLA = Living area ÷ (4) = 0.52 (91)

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

(92)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(92)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

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

(93)m=	19.56	19.91	20.24	20.51	20.61	20.66	20.67	20.67	20.64	20.48	20.03	19.51	(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=	0.84	0.76	0.66	0.52	0.39	0.26	0.19	0.21	0.35	0.58	0.77	0.85	(94)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	677.74	746.67	751.8	671.35	533.85	359.18	242.16	252.42	388.15	553.61	625.8	648.64	(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=	980.06	958.76	873.08	717.29	547.73	361.72	242.7	253.21	395.1	607.24	803.65	962.22	(97)
--------	--------	--------	--------	--------	--------	--------	-------	--------	-------	--------	--------	--------	------

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
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Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 902.34 (98)

Space heating requirement in kWh/m²/year

11.17 (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 0 561.16 441.77 451.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.19 437.01 444.67 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1516.15 1453.76 1349.69 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 x (98)m

(104)m = 0 0 0 0 0 695.49 756.46 673.34 0 0 0 0

Total = Sum(104) = 2125.29 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (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) = 0 (106)

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

(107)m = 0 0 0 0 0 148.53 161.55 143.8 0 0 0 0

Total = Sum(107) = 453.88 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	----------

Space heating requirement (calculated above)

224.92	142.52	90.24	33.08	10.32	0	0	0	0	39.9	128.05	233.31	
--------	--------	-------	-------	-------	---	---	---	---	------	--------	--------	--

(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

132.31	83.84	53.08	19.46	6.07	0	0	0	0	23.47	75.32	137.24	
--------	-------	-------	-------	------	---	---	---	---	-------	-------	--------	--

Total (kWh/year) =Sum(211)_{1...5,10...12} = 530.79 (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)

SAP WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
---------	-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

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

1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

(221)m=	0	0	0	0	0	26.51	28.84	25.67	0	0	0	0
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Total = Sum(221)_{6...8} =

81.01 (221)

Annual totals

Space heating fuel used, main system 1

530.79

Water heating fuel used

1816.27

Space cooling fuel used

81.01

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.77 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) =

222.77 (231)

Electricity for lighting

347.95 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

2998.79 (338)

10a. Fuel costs - individual heating systems:

	Fuel kWh/year	Fuel Price (Table 12)	Fuel Cost £/year
Space heating - main system 1	(211) x	13.19 x 0.01 =	70.01 (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 (electric off-peak tariff)			
High-rate fraction (Table 13, or Appendix F for electric CPSU)		1	(243)
Low-rate fraction	1.0 - (243) =	0	(244)
High-rate cost	(219) x (243) x	13.19 x 0.01 =	239.57 (245)
Low-rate cost	(219) x (244) x	13.19 x 0.01 =	0 (246)
Space cooling	(221)	13.19 x 0.01 =	10.69 (248)
Pumps, fans and electric keep-hot	(231)	13.19 x 0.01 =	29.38 (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 =	45.89 (250)
Additional standing charges (Table 12)			0 (251)
Appendix Q items: repeat lines (253) and (254) as needed			
Total energy cost	(245)...(247) + (250)...(254) =		395.54 (255)

SAP WorkSheet: New dwelling design stage

11a. SAP rating - individual heating systems

Energy cost deflator (Table 12)		0.42	(256)
Energy cost factor (ECF)	$[(255) \times (256)] \div [(4) + 45.0] =$	1.32	(257)
SAP rating (Section 12)		81.57	(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	0.519	=	275.48	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.519	=	942.64	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1218.13	(265)
Space cooling	(221) x	0.519	=	42.05	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	115.62	(267)
Electricity for lighting	(232) x	0.519	=	180.59	(268)
Total CO2, kg/year		sum of (265)...(271) =		1556.37	(272)
CO2 emissions per m²		(272) ÷ (4) =		19.27	(273)
El rating (section 14)				83	(274)

13a. Primary Energy

	Energy kWh/year	Primary factor		P. Energy kWh/year	
Space heating (main system 1)	(211) x	3.07	=	1629.53	(261)
Space heating (secondary)	(215) x	3.07	=	0	(263)
Energy for water heating	(219) x	3.07	=	5575.95	(264)
Space and water heating	(261) + (262) + (263) + (264) =			7205.48	(265)
Space cooling	(221) x	3.07	=	248.71	(266)
Electricity for pumps, fans and electric keep-hot	(231) x	3.07	=	683.89	(267)
Electricity for lighting	(232) x	0	=	1068.21	(268)
'Total Primary Energy		sum of (265)...(271) =		9206.29	(272)
Primary energy kWh/m²/year		(272) ÷ (4) =		114.01	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version:

Version: 1.0.5.60

Property Address: Level 38 Flat 38 07

Address :

1. Overall dwelling dimensions:

	Area(m ²)	Av. Height(m)	Volume(m ³)
Ground floor	80.75 (1a) x	2.7 (2a) =	218.03 (3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	80.75 (4)		
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	218.03 (5)

2. Ventilation rate:

	main heating	secondary heating	other	total	m ³ 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				0 x 10 =	0 (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) =	0 ÷ (5) = 0 (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) 0.25 (18)

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

Number of sides sheltered 3 (19)

Shelter factor (20) = 1 - [0.075 x (19)] = 0.78 (20)

Infiltration rate incorporating shelter factor (21) = (18) x (20) = 0.19 (21)

Infiltration rate modified for monthly wind speed

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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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
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DER WorkSheet: New dwelling design stage

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

0.25	0.24	0.24	0.21	0.21	0.18	0.18	0.18	0.19	0.21	0.22	0.23
------	------	------	------	------	------	------	------	------	------	------	------

Calculate effective air change rate for the applicable case

If mechanical ventilation:

0.5 (23a)

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

0.5 (23b)

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

75.65 (23c)

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

(24a)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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 x (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 x (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 0 0 0 0 0 0 0 0 0 0 0 (24d)

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

(25)m= 0.37 0.36 0.36 0.33 0.33 0.31 0.31 0.3 0.32 0.33 0.34 0.35 (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
Windows Type 1			21.27	x 1/[1/(1) + 0.04]	20.45		(27)
Windows Type 2			8.52	x 1/[1/(1) + 0.04]	8.19		(27)
Windows Type 3			1.57	x 1/[1/(1) + 0.04]	1.51		(27)
Windows Type 4			2.56	x 1/[1/(1) + 0.04]	2.46		(27)
Walls	41.1	33.92	7.18	x 0.24	1.72		(29)
Total area of elements, m²			41.1				(31)
Party wall			35.48	x 0	0		(32)
Party wall			29.95	x 0	0		(32)
Party floor			80.75				(32a)
Party ceiling			80.75				(32b)
Internal wall **			102.06				(32c)

* 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) = 34.34 (33)

Heat capacity Cm = S(A x k) ((28)...(30) + (32) + (32a)...(32e) = 16862.66 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Low 100 (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 3.36 (36)

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

Total fabric heat loss (33) + (36) = 37.7 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly

$$(38)m = 0.33 \times (25)m \times (5)$$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	26.53	26.18	25.84	24.09	23.75	22	22	21.65	22.7	23.75	24.44	25.14	(38)

Heat transfer coefficient, W/K

$$(39)m = (37) + (38)m$$

(39)m=	64.23	63.88	63.53	61.79	61.44	59.7	59.7	59.35	60.4	61.44	62.14	62.83	
Average = Sum(39) _{1...12} /12=												61.7	(39)

Heat loss parameter (HLP), W/m²K

$$(40)m = (39)m \div (4)$$

(40)m=	0.8	0.79	0.79	0.77	0.76	0.74	0.74	0.73	0.75	0.76	0.77	0.78	
Average = Sum(40) _{1...12} /12=												0.76	(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

if TFA > 13.9, $N = 1 + 1.76 \times [1 - \exp(-0.000349 \times (TFA - 13.9)^2)] + 0.0013 \times (TFA - 13.9)$

if TFA ≤ 13.9, N = 1

	2.48	(42)
--	------	------

Annual average hot water usage in litres per day $V_{d,average} = (25 \times N) + 36$

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more than 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 $V_{d,m} = \text{factor from Table 1c} \times (43)$													

(44)m=	102.33	98.61	94.89	91.17	87.45	83.72	83.72	87.45	91.17	94.89	98.61	102.33	
Total = Sum(44) _{1...12} =												1116.33	(44)

Energy content of hot water used - calculated monthly = $4.190 \times V_{d,m} \times n_m \times DT_m / 3600$ kWh/month (see Tables 1b, 1c, 1d)

(45)m=	151.75	132.72	136.96	119.4	114.57	98.87	91.61	105.13	106.38	123.98	135.33	146.96	
Total = Sum(45) _{1...12} =												1463.68	(45)

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

(46)m=	22.76	19.91	20.54	17.91	17.19	14.83	13.74	15.77	15.96	18.6	20.3	22.04	(46)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------	------	-------	------

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel	190	(47)
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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):	1.61	(48)
---	------	------

Temperature factor from Table 2b	0.6	(49)
----------------------------------	-----	------

Energy lost from water storage, kWh/year	(48) x (49) =	0.97	(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)	0.97	(55)
----------------------------	------	------

Water storage loss calculated for each month $((56)m = (55) \times (41)m$

(56)m=	29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95	(56)
--------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	------

DER WorkSheet: New dwelling design stage

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

(57)m=

29.95	27.05	29.95	28.98	29.95	28.98	29.95	29.95	28.98	29.95	28.98	29.95
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (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)

Output from water heater

(64)m=

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
-------	--------	-------	--------	--------	--------	--------	--------	--------	--------	--------	--------

Output from water heater (annual) _{1...12}	1816.27
---	---------

 (64)

Heat gains from water heating, kWh/month $0.25 \times [0.85 \times (45)m + (61)m] + 0.8 \times [(46)m + (57)m + (59)m]$

(65)m=

74.41	65.77	69.5	62.89	62.05	56.06	54.42	58.91	58.56	65.18	68.18	72.82
-------	-------	------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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

(66)m=

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85	123.85

 (66)

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

(67)m=

19.7	17.5	14.23	10.77	8.05	6.8	7.35	9.55	12.82	16.28	19	20.25
------	------	-------	-------	------	-----	------	------	-------	-------	----	-------

 (67)

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

(68)m=

221	223.29	217.52	205.21	189.68	175.09	165.33	163.04	168.82	181.12	196.65	211.25
-----	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (68)

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

(69)m=

35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38	35.38
-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------

 (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=

-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08	-99.08
--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------	--------

 (71)

Water heating gains (Table 5)

(72)m=

100.02	97.87	93.41	87.34	83.4	77.86	73.14	79.18	81.33	87.61	94.7	97.88
--------	-------	-------	-------	------	-------	-------	-------	-------	-------	------	-------

 (72)

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

(73)m=

400.88	398.82	385.31	363.48	341.29	319.9	305.98	311.93	323.12	345.16	370.5	389.53
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 (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 m ²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)
--------------	---------------------------	------------------------	------------------	----------------	----------------	--------------

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	1.57	x	10.63	x	0.4	x	1	=	4.63	(74)
North	0.9x	0.77	x	2.56	x	10.63	x	0.4	x	0.7	=	5.28	(74)
North	0.9x	0.77	x	1.57	x	20.32	x	0.4	x	1	=	8.84	(74)
North	0.9x	0.77	x	2.56	x	20.32	x	0.4	x	0.7	=	10.09	(74)
North	0.9x	0.77	x	1.57	x	34.53	x	0.4	x	1	=	15.03	(74)
North	0.9x	0.77	x	2.56	x	34.53	x	0.4	x	0.7	=	17.15	(74)
North	0.9x	0.77	x	1.57	x	55.46	x	0.4	x	1	=	24.14	(74)
North	0.9x	0.77	x	2.56	x	55.46	x	0.4	x	0.7	=	27.55	(74)
North	0.9x	0.77	x	1.57	x	74.72	x	0.4	x	1	=	32.52	(74)
North	0.9x	0.77	x	2.56	x	74.72	x	0.4	x	0.7	=	37.11	(74)
North	0.9x	0.77	x	1.57	x	79.99	x	0.4	x	1	=	34.81	(74)
North	0.9x	0.77	x	2.56	x	79.99	x	0.4	x	0.7	=	39.73	(74)
North	0.9x	0.77	x	1.57	x	74.68	x	0.4	x	1	=	32.5	(74)
North	0.9x	0.77	x	2.56	x	74.68	x	0.4	x	0.7	=	37.1	(74)
North	0.9x	0.77	x	1.57	x	59.25	x	0.4	x	1	=	25.78	(74)
North	0.9x	0.77	x	2.56	x	59.25	x	0.4	x	0.7	=	29.43	(74)
North	0.9x	0.77	x	1.57	x	41.52	x	0.4	x	1	=	18.07	(74)
North	0.9x	0.77	x	2.56	x	41.52	x	0.4	x	0.7	=	20.62	(74)
North	0.9x	0.77	x	1.57	x	24.19	x	0.4	x	1	=	10.53	(74)
North	0.9x	0.77	x	2.56	x	24.19	x	0.4	x	0.7	=	12.02	(74)
North	0.9x	0.77	x	1.57	x	13.12	x	0.4	x	1	=	5.71	(74)
North	0.9x	0.77	x	2.56	x	13.12	x	0.4	x	0.7	=	6.52	(74)
North	0.9x	0.77	x	1.57	x	8.86	x	0.4	x	1	=	3.86	(74)
North	0.9x	0.77	x	2.56	x	8.86	x	0.4	x	0.7	=	4.4	(74)
Southwest	0.9x	0.77	x	21.27	x	36.79		0.4	x	0.8	=	173.55	(79)
Southwest	0.9x	0.77	x	21.27	x	62.67		0.4	x	0.8	=	295.62	(79)
Southwest	0.9x	0.77	x	21.27	x	85.75		0.4	x	0.8	=	404.48	(79)
Southwest	0.9x	0.77	x	21.27	x	106.25		0.4	x	0.8	=	501.17	(79)
Southwest	0.9x	0.77	x	21.27	x	119.01		0.4	x	0.8	=	561.35	(79)
Southwest	0.9x	0.77	x	21.27	x	118.15		0.4	x	0.8	=	557.29	(79)
Southwest	0.9x	0.77	x	21.27	x	113.91		0.4	x	0.8	=	537.29	(79)
Southwest	0.9x	0.77	x	21.27	x	104.39		0.4	x	0.8	=	492.39	(79)
Southwest	0.9x	0.77	x	21.27	x	92.85		0.4	x	0.8	=	437.97	(79)
Southwest	0.9x	0.77	x	21.27	x	69.27		0.4	x	0.8	=	326.72	(79)
Southwest	0.9x	0.77	x	21.27	x	44.07		0.4	x	0.8	=	207.87	(79)
Southwest	0.9x	0.77	x	21.27	x	31.49		0.4	x	0.8	=	148.52	(79)
West	0.9x	0.77	x	8.52	x	19.64	x	0.4	x	1	=	46.39	(80)
West	0.9x	0.77	x	8.52	x	38.42	x	0.4	x	1	=	90.74	(80)
West	0.9x	0.77	x	8.52	x	63.27	x	0.4	x	1	=	149.43	(80)
West	0.9x	0.77	x	8.52	x	92.28	x	0.4	x	1	=	217.94	(80)
West	0.9x	0.77	x	8.52	x	113.09	x	0.4	x	1	=	267.1	(80)

DER WorkSheet: New dwelling design stage

West	0.9x	0.77	x	8.52	x	115.77	x	0.4	x	1	=	273.42	(80)
West	0.9x	0.77	x	8.52	x	110.22	x	0.4	x	1	=	260.31	(80)
West	0.9x	0.77	x	8.52	x	94.68	x	0.4	x	1	=	223.6	(80)
West	0.9x	0.77	x	8.52	x	73.59	x	0.4	x	1	=	173.8	(80)
West	0.9x	0.77	x	8.52	x	45.59	x	0.4	x	1	=	107.67	(80)
West	0.9x	0.77	x	8.52	x	24.49	x	0.4	x	1	=	57.84	(80)
West	0.9x	0.77	x	8.52	x	16.15	x	0.4	x	1	=	38.14	(80)

Solar gains in watts, calculated for each month

(83)m = Sum(74)m ... (82)m

(83)m=	229.85	405.3	586.1	770.8	898.08	905.26	867.19	771.21	650.46	456.94	277.94	194.93	(86)
--------	--------	-------	-------	-------	--------	--------	--------	--------	--------	--------	--------	--------	------

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

(84)m=	630.72	804.12	971.41	1134.29	1239.37	1225.15	1173.17	1083.14	973.58	802.1	648.44	584.46	(84)
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7. Mean internal temperature (heating season)

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

21 (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=	0.92	0.85	0.75	0.59	0.44	0.31	0.22	0.25	0.41	0.68	0.87	0.93	(86)

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

(87)m=	19.76	20.14	20.51	20.81	20.94	20.99	21	21	20.97	20.76	20.24	19.71	(87)
--------	-------	-------	-------	-------	-------	-------	----	----	-------	-------	-------	-------	------

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

(88)m=	20.26	20.26	20.26	20.28	20.29	20.31	20.31	20.31	20.3	20.29	20.28	20.27	(88)
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Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.91	0.84	0.73	0.57	0.41	0.28	0.19	0.21	0.38	0.65	0.85	0.93	(89)
--------	------	------	------	------	------	------	------	------	------	------	------	------	------

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

(90)m=	18.6	19.13	19.65	20.06	20.23	20.3	20.3	20.31	20.27	20.01	19.29	18.53	(90)
--------	------	-------	-------	-------	-------	------	------	-------	-------	-------	-------	-------	------

fLA = Living area ÷ (4) =

0.52 (91)

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

(92)m=	19.2	19.65	20.1	20.45	20.6	20.66	20.66	20.67	20.63	20.4	19.78	19.14	(92)
--------	------	-------	------	-------	------	-------	-------	-------	-------	------	-------	-------	------

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

(93)m=	19.2	19.65	20.1	20.45	20.6	20.66	20.66	20.67	20.63	20.4	19.78	19.14	(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
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Utilisation factor for gains, hm:

(94)m=	0.9	0.83	0.72	0.57	0.43	0.29	0.21	0.23	0.39	0.65	0.84	0.91	(94)
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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	566.49	664.63	702.5	651.51	527.85	357.99	241.89	251.98	384.12	524.13	545.87	533.64	(95)
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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)
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Heat loss rate for mean internal temperature, Lm , W = [(39)m x [(93)m – (96)m]

(97)m=	957.19	942.39	863.76	713.86	546.74	361.54	242.65	253.14	394.45	602.01	787.98	938.9	(97)
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Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	290.68	186.66	119.98	44.89	14.06	0	0	0	0	57.95	174.32	301.51	
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DER WorkSheet: New dwelling design stage

Total per year (kWh/year) = Sum(98)_{1...5,9...12} = 1190.04 (98)

Space heating requirement in kWh/m²/year

14.74 (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
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Heat loss rate Lm (calculated using 25°C internal temperature and external temperature from Table 10)

(100)m = 0 0 0 0 0 561.16 441.77 451.06 0 0 0 0 (100)

Utilisation factor for loss hm

(101)m = 0 0 0 0 0 0.98 0.99 0.99 0 0 0 0 (101)

Useful loss, hmLm (Watts) = (100)m x (101)m

(102)m = 0 0 0 0 0 550.19 437.01 444.67 0 0 0 0 (102)

Gains (solar gains calculated for applicable weather region, see Table 10)

(103)m = 0 0 0 0 0 1516.15 1453.76 1349.69 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 x (98)m

(104)m = 0 0 0 0 0 695.49 756.46 673.34 0 0 0 0

Total = Sum(104) = 2125.29 (104)

Cooled fraction

f C = cooled area ÷ (4) = 0.85 (105)

Intermittency factor (Table 10b)

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

Total = Sum(106) = 0 (106)

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

(107)m = 0 0 0 0 0 148.53 161.55 143.8 0 0 0 0

Total = Sum(107) = 453.88 (107)

Space cooling requirement in kWh/m²/year

(107) ÷ (4) = 5.62 (108)

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) x [1 – (203)] =

1 (204)

Efficiency of main space heating system 1

170 (206)

Efficiency of secondary/supplementary heating system, %

0 (208)

Cooling System Energy Efficiency Ratio

5.6 (209)

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

Space heating requirement (calculated above)

290.68	186.66	119.98	44.89	14.06	0	0	0	0	57.95	174.32	301.51
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(211)m = {[(98)m x (204)] } x 100 ÷ (206) (211)

170.99	109.8	70.58	26.41	8.27	0	0	0	0	34.09	102.54	177.36
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Total (kWh/year) =Sum(211)_{1...5,10...12} = 700.02 (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)

DER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
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Efficiency of water heater

100 (216)

(217)m= 100 100 100 100 100 100 100 100 100 100 100 100 (217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

181.7	159.77	166.9	148.38	144.52	127.85	121.56	135.07	135.36	153.93	164.31	176.91
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Total = Sum(219a)_{1..12} = 1816.27 (219)

Space cooling fuel, kWh/month.

(221)m = (107)m ÷ (209)

0	0	0	0	0	26.51	28.84	25.67	0	0	0	0
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Total = Sum(221)_{6..8} = 81.01 (221)

Annual totals

Space heating fuel used, main system 1

kWh/year

700.02

Water heating fuel used

1816.27

Space cooling fuel used

81.01

Electricity for pumps, fans and electric keep-hot

mechanical ventilation - balanced, extract or positive input from outside

222.77 (230a)

Total electricity for the above, kWh/year

sum of (230a)...(230g) = 222.77 (231)

Electricity for lighting

347.95 (232)

Total delivered energy for all uses (211)...(221) + (231) + (232)...(237b) =

3168.03 (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	0.519	363.31 (261)
Space heating (secondary)	(215) x	0.519	0 (263)
Water heating	(219) x	0.519	942.64 (264)
Space and water heating	(261) + (262) + (263) + (264) =		1305.96 (265)
Space cooling	(221) x	0.519	42.05 (266)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	115.62 (267)
Electricity for lighting	(232) x	0.519	180.59 (268)
Total CO2, kg/year		sum of (265)...(271) =	1644.21 (272)
Dwelling CO2 Emission Rate		(272) ÷ (4) =	20.36 (273)
EI rating (section 14)			82 (274)