Belmont Street Site, Camden
Energy Statement

October 2020

Vistry Partnerships

Energy Strategy

Charlie Ratchford Resource Centre, Belmont Street, London

Iceni Projects Limited on behalf of

Vistry Partnerships Ltd

September 2020

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SEPTEMBER 2020

ICENI PROJECTS LIMITED ON BEHALF OF VISTRY PARTNERSHIPS LTD

Energy Strategy
CHARLIE RATCHFORD RESOURCE CENTRE, BELMONT STREET, LONDON

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APPENDICES

1. EXECUTIVE SUMMARY

1.1 Iceni Projects Ltd was commissioned by Vistry Partnerships Ltd to produce an Energy Strategy for the proposed redevelopment of the land currently occupied by the former Charlie Ratchford Resource Centre on Belmont Street, Chalk Farm, NW1 8HF.

1.2 This document details the carbon dioxide (CO_2) emissions reduction measures adopted by the proposed development and gives an overview of the design proposals that will ensure the development operates in an energy efficient manner over the lifespan of the scheme.

1.3 The scheme proposes the redevelopment of the site to provide 115 new residential dwellings from the ground to the ninth-floor level, together with associated landscaping and ancillary uses.

1.4 The energy strategy for the proposed development has been assessed using the Greater London Authority's (GLA) methodology set out in the London Plan and associated documents. This approach is consistent with that required by the London Borough of Camden Local Plan Policy CC1, and therefore represents best practice in meeting the required standards of energy efficiency and carbon dioxide (CO_2) emissions reduction.

1.5 The proposed energy strategy is based upon the principles of the Energy Hierarchy on the basis that it is preferable to reduce carbon dioxide emissions through reduced energy consumption above decarbonisation through alternative energy sources.

1.6 The key measures proposed to minimise carbon dioxide emissions of the proposed development are set out below.

1.7 The proposed 'Be Lean' measures include:

- High levels of building fabric insulation to minimise heat loss
- A balanced proportion of façade glazing to ensure natural daylight provision without increasing overheating risk
- High levels of air tightness to reduce heat loss through infiltration
- The use of accredited construction details to minimise heat loss through thermal bridging
- Low energy LED lighting to minimise artificial lighting energy consumption
- Mechanical ventilation with heat recovery to provide fresh air, with heat recovered from extract air

- A high specification of heating controls to ensure operational efficiency

1.8 The ‘Be Green’ measures include:

- Employment of a highly efficient, communal air source heat pump system
- 202 roof-top solar photovoltaic panels to provide renewable energy

1.9 Incorporation of the measures outlined above will deliver savings of 79.4 tCO_2 per year for the proposed dwellings, which equates to a 71% improvement over the Part L 2013 baseline using the SAP10 carbon dioxide emissions factors. The level of emissions reduction achieved for each stage of the Energy Hierarchy is shown below.

Figure 1.1 Carbon dioxide emissions savings after each stage of the Energy Hierarchy

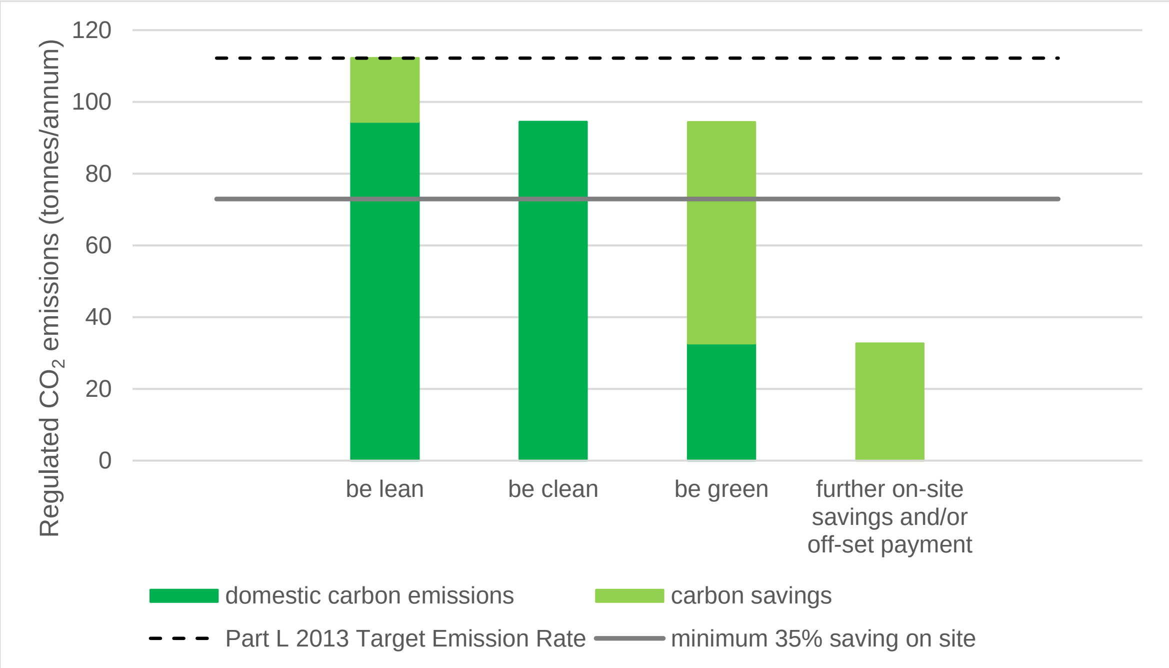


Table 1.1 Carbon dioxide emissions after each stage of the Energy Hierarchy

	Carbon dioxide emissions for domestic buildings (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	112.2	114.4
After energy demand reduction	94.5	114.4
After renewable energy	32.7	114.4

Table 1.2 Regulated carbon dioxide savings from each stage of the Energy Hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	**(%)**
Savings from energy demand reduction	17.7	16%
Savings from renewable energy	61.7	55%
Cumulative on-site savings	79.4	71%
Annual savings from offset payment	32.7	
	(Tonnes CO_2)	
Cumulative savings for offset payment	982	
Cash in-lieu contribution	£93,324	

1.10 The above analysis shows that the proposed development at Belmont Street, Chalk Farm is able to achieve an on-site saving of 71% in carbon dioxide emissions through the combination of measures set out above.

1.11 Overall, the proposals are therefore in accordance with national, local and regional policy requirements, and will provide a development that seeks to promote these principles in operation.

2. INTRODUCTION

2.1 Iceni Projects Ltd was commissioned by Vistry Partnerships Ltd to produce an Energy Strategy for the proposed redevelopment of the land currently occupied by the former Charlie Ratchford Resource Centre on Belmont Street, Chalk Farm, NW1 8HF.

Report Objective

2.2 This document details the carbon dioxide (CO_2) emissions reduction measures adopted by the proposed development and gives an overview of the design proposals that will ensure the development operates in an energy efficient manner over the lifespan of the scheme. The Energy Strategy report headlines will provide a framework for the project team to operate consistently within sustainability guidelines set out by the Greater London Authority and the London Borough of Camden.

2.3 The report is structured to meet these guidelines as follows:

- Section 3 discusses the planning context and policies which are relevant to energy;
- Section 4 discusses the development response to the policy drivers for energy; and
- Section 5 summarises the development's design response.

Site and Surroundings

2.4 The application site (Appendix A1) is situated between Belmont Street and Crogsland Road, approximately 0.2 miles north east of Chalk Farm Underground Station.

2.5 The site is bound by Belmont Street to the east, and Crogsland Road to the west. Adjacent to the north is the Denton Estate, a residential development comprised of 19 four-storey apartment blocks, whilst the area to the south is characterised by a mix of commercial, retail and hotel uses. Residential buildings border the site to the east, with the plot adjacent to the proposed development site currently under development. Beyond this plot is Bryant Court, an assisted living facility for the elderly.

2.6 The site is currently occupied by the former Charlie Ratchford Resource Centre, which is a purpose-built single storey building the stands within a landscaped area between Belmont Street and Crogsland Road. The main entrance is on Belmont Street, which can also be accessed on foot via a footpath from Crogsland Road.

The Proposed Development

2.7 The scheme proposes the redevelopment of the site to provide a total of 115 residential dwellings from the ground to the ninth-floor level.

2.8 The scheme comprises of the following mix of residential dwellings:

Table 2.1 Residential dwelling mix

Dwelling Type	Number
1B1P	37
1B2P	39
2B3P	14
2B4P	22
3B5P	1
3B6P	2
Total	**115**

2.9 The images below show elevations of the scheme, based on the information provided by HTA Architects in August 2020.

Figure 2.1 North elevation (Blocks B and C)

Figure 2.2 North east elevation (Block B)

Figure 2.3 East elevation (Block A)

Figure 2.4 West elevation (Block C)

Figure 2.5 South elevation (Block A and C)

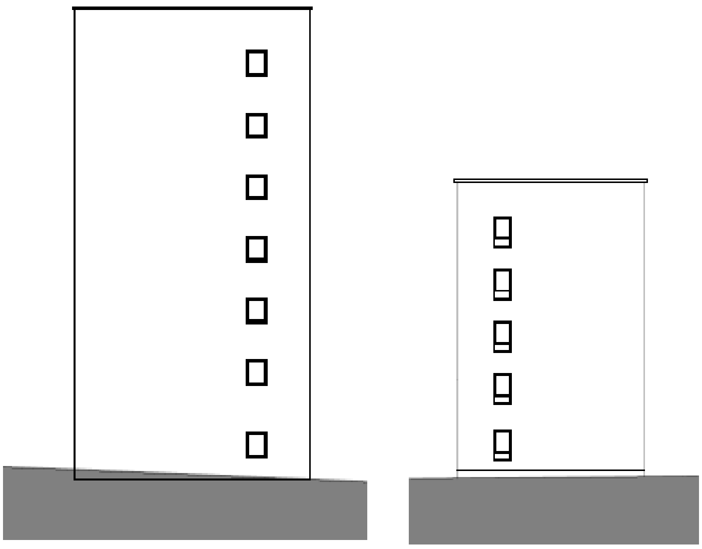


Figure 2.6 East elevation (Block C)

Figure 2.7 South west elevation (Block B)

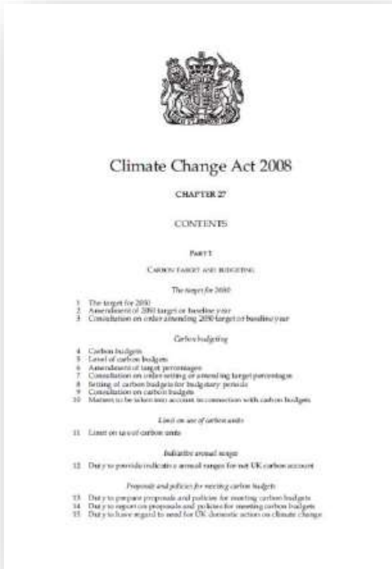
Figure 2.8 West elevation (Block A)

3. PLANNING AND REGULATORY CONTEXT

3.1 Built environment energy efficiency and carbon dioxide emissions are incorporated within policy and regulation at a national, regional and local level, as set out below.

National

Climate Change Act 2008

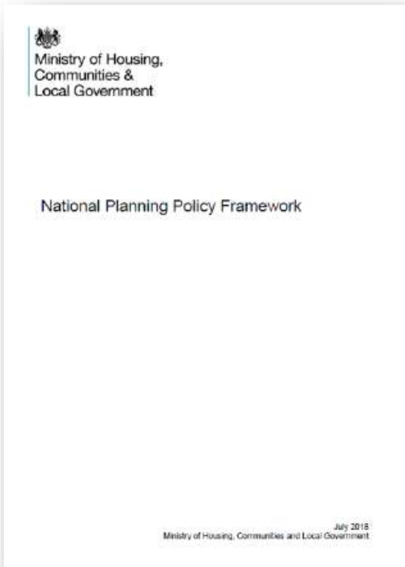


3.2 On 26th November 2008, the UK Government published the Climate Change Act 2008; the world's first long-term legally binding framework to mitigate against climate change. Within this framework, the Act sets legally binding targets to increase greenhouse gas emission reductions through action in the UK and abroad from the 60% target set out in the Energy White Paper, to 80% by 2050.

3.3 As required under Section 34 of the Climate Change Act, the Fifth Annual Carbon Budget was accepted by the Government in June 2016. This sets out a budget for UK emissions for the period 2028 – 2032.

3.4 Following a commitment in June 2019, the Climate Change Act has been amended to target net zero carbon emissions by 2050.

National Planning Policy Framework



3.5 The Ministry of Housing, Communities & Local Government determines national policies on different aspects of planning and the rules that govern the operation of the system. Accordingly, the National Planning Policy Framework (NPPF), which came into force in March 2012 and was updated in February 2019, aims to strengthen local decision making.

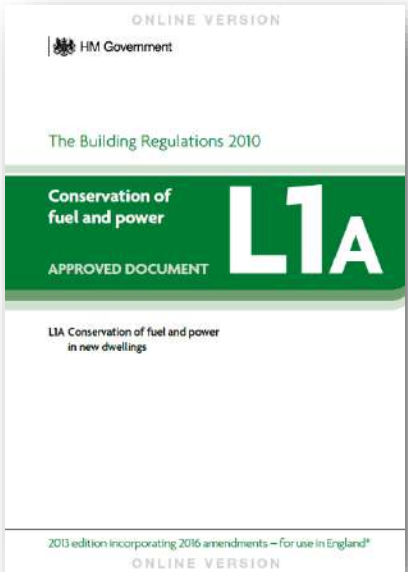
3.6 Paragraphs 10 and 11 of the NPPF confirm that at the heart of this document is a "*presumption in favour of sustainable development*", and that development proposals that accord with an up-to-date development plan should be approved without delay.

Building Regulations Part L

3.7 Part L of the Building Regulations relates to the conservation of fuel and power, and applies to both new and existing buildings. The current edition covers the energy efficiency requirements of the building regulations as set out in Part L of Schedule 1 to the Building Regulations. Technical guidance is contained in 4 Part L Approved Documents and 2 building services compliance guides.

3.8 The documents of relevance to this scheme include:

- **Approved Document L1A:2013.** This provides the methodology for new build, domestic buildings to meet current energy efficiency standards, including backstop U-values, carbon dioxide emissions calculations and minimising the risk of overheating. Carbon dioxide emissions reductions are prescribed for ‘regulated’ emissions only, and relate to heating, hot water, lighting, auxiliary and cooling (where specified). Emissions from domestic appliances (cooking, for example) are considered to be unregulated emissions, and are excluded from the analysis.



- **Domestic Building Services Compliance Guide.** This provides minimum building services efficiencies for domestic buildings.

Regional

3.9 Within Greater London, key sustainable development principles for economic, environmental and social improvement are set out below:

The London Plan (March 2016)

3.10 The London Plan is the overall strategic plan for London and includes policies for sustainable development and energy within Chapter 5 (London's response to climate change). Key policies of relevance to this scheme are as follows:

- **Policy 5.2 Minimising Carbon Dioxide Emissions.** This states that development proposals should make the fullest contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

  1. Be lean: use less energy
  2. Be clean: supply energy efficiently
  3. Be green: use renewable energy

- **Policy 5.3 Sustainable Design and Construction.** This states that development proposals should demonstrate that sustainable design standards are integral to the proposal, including its construction and operation, and ensure that they are considered at the beginning of the design process.

- **Policy 5.6 Decentralised Energy in Development Proposals.** This states that major development proposals should select energy systems in accordance with the following hierarchy:

  1. Connection to existing heating or cooling networks;
  2. Site-wide CHP network;
  3. Communal heating and cooling;

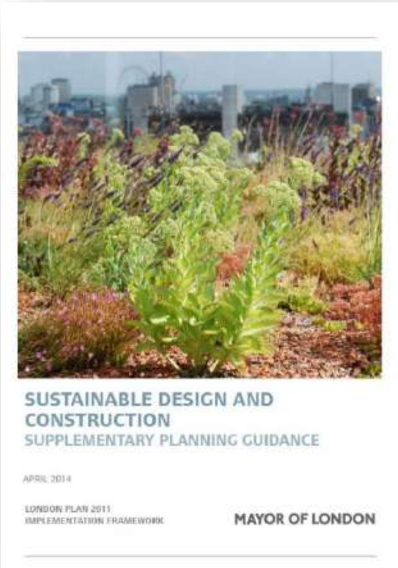
- **Policy 5.7 Renewable Energy.** This states that major development proposals should provide a reduction in expected carbon dioxide emissions through the use of on-site renewable energy generation, where feasible.

- **Policy 5.9 Overheating and Cooling.** This states that major development proposals should reduce potential overheating and reliance on air conditioning systems and demonstrate this in accordance with the following cooling hierarchy:

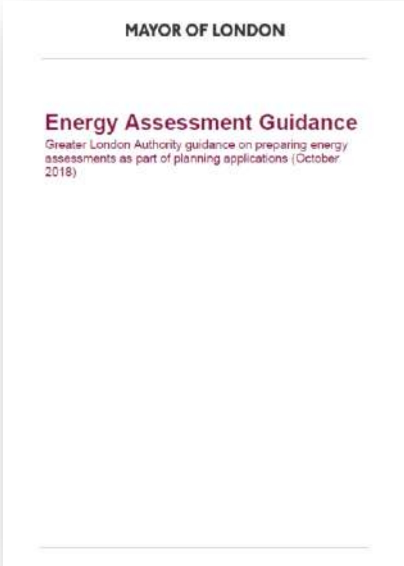
  1. Minimise internal heat generation through energy efficient design
  2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls
  3. Manage the heat within the building through exposed internal thermal mass and high ceilings
  4. Passive ventilation
  5. Mechanical ventilation
  6. Active cooling systems (ensuring they are the lowest carbon options).

Sustainable Design and Construction Supplementary Planning Guidance (SPG) (April 2014)

3.11 This document provides guidance on the implementation of London Plan policy 5.3 ‘Sustainable Design and Construction’ as well as a range of policies relating to environmental sustainability. The document contains best practice and priority targets for a wide range of issues related to sustainable design and construction, grouped into three categories: resource management, adapting to climate change and greening the city, and pollution management.



Energy Planning – GLA guidance on preparing energy assessments (October 2018)



3.12 The guidance note provides further detail on addressing the London Plan's energy hierarchy through the provision of an energy assessment to accompany planning applications. The document sets out the expected carbon dioxide emissions targets for the following building types:

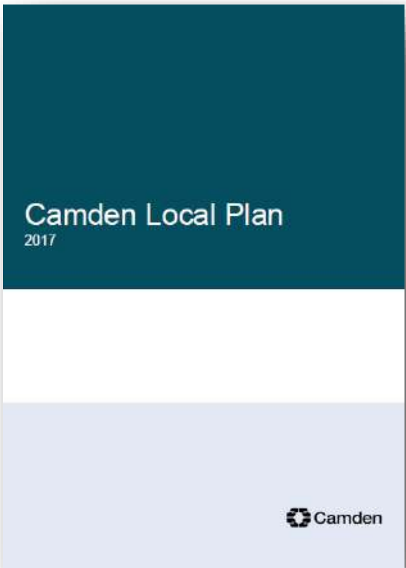
- New build residential buildings are expected to meet a zero-carbon target. This is made up of a minimum 35% reduction in regulated carbon dioxide emissions (beyond Part L 2013) on-site. The remaining regulated carbon dioxide emissions, to 100%, are to be offset through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

3.13 The latest "Energy Assessment Guidance" (October 2018) states that from January 2019 "planning applicants are encouraged to use the SAP 10 emission factors for referable applications when estimating CO_2 emission performance against London Plan policies".

Local

3.14 In determining the local context, the London Borough of Camden policy is gained through the Camden Local Plan, adopted in July 2017.

Camden Local Plan (adopted July 2017)



3.15 The Camden Local Plan is the key strategic document in Camden's development plan. It sets out the vision for shaping the future of the Borough and contains policies for guiding planning decisions. Policies of relevance to this project in the context of sustainability and energy are as follows:

- **Policy CC1 (Climate change mitigation)** states that the Council will require all development to minimise the effects of climate change and encourage all developments to meet the highest feasible environmental standards that are financially viable during construction and occupation. The Council will:

- Promote zero carbon development and require all development to reduce carbon dioxide emissions through following the steps in the energy hierarchy;
- Require all major development to demonstrate how London Plan targets for carbon dioxide emissions have been met;
- Ensure that the location of development and mix of land uses minimise the need to travel by car and help to support decentralised energy networks;
- Support and encourage sensitive energy efficiency improvements to existing buildings;
- Require all proposals that involve substantial demolition to demonstrate that it is not possible to retain and improve the existing building; and
- Expect all developments to optimise resource efficiency.

The Council will promote decentralised energy by:

- Working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them;
- Protecting existing decentralised energy networks (e.g. at Gower Street, Bloomsbury, King's Cross, Gospel Oak and Somers Town) and safeguarding potential network routes; and
- Requiring all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

To ensure that the Council can monitor the effectiveness of renewable and low carbon technologies, major developments will be required to install appropriate monitoring equipment.

- **Policy CC2 (Adapting to Climate Change)** states that the Council will promote and measure sustainable design and construction by:
    - Ensuring development schemes demonstrate how adaptation measures and sustainable development principles have been incorporated into the design and proposed implementation; and
    - Encouraging new build residential development to use the Home Quality Mark and Passivhaus design standards.

Camden Planning Guidance: Energy Efficiency and Adaptation (March 2019)

3.16 This document supports the policies outlines in the Camden Local Plan 2017. This planning guidance document provides information on key energy and resource issues within Camden, and supports Local Plan Policies CC1 (Climate change mitigation) and CC2 (Adapting to climate change).

Borough Wide Heat Demand and Heat Source Mapping: London Borough of Camden (May 2015)

3.17 The Borough Wide Heat Demand and Heat Source Mapping assessment was undertaken for the London Borough of Camden by Buro Happold Engineering in 2015. The purpose of this assessment was to provide an update to the Camden Large Scale CHP Pilot Site identification study undertaken in 2007. It provides an update on the Borough-wide heat demand map, determines the potential for locations to act as secondary heat supply sources, and identifies key opportunity areas for the establishment of decentralised energy networks. Furthermore, a number of building typologies with significant heat demands have been identified. These anchor loads have then been used to inform locations for new decentralised energy networks.

Declaration of a Climate Emergency (April 2019)

3.18 In April 2019, Camden Council declared a Climate Emergency, alongside a commitment to achieve a target of net zero emissions by 2030. In July 2019, Camden held the UK's first Citizens' Assembly on the climate crisis. The Assembly proposals will inform a new Climate Action Plan for Camden, which will be published in 2020.

Other Considerations

The Draft London Plan (December 2017 and updated December 2019)

3.19 Although not formally adopted, the GLA will start to give weight to the draft New London Plan immediately following publication, and increased weight will be applied as the draft progresses through the adoption process. Key policies of relevance to this scheme are as follows:

- **Policy SI2 Minimising Greenhouse Gas Emissions.** This policy extends the zero-carbon requirement to new non-domestic buildings. The policy adds a fourth layer to the energy hierarchy which requires development to monitor, verify and report on energy performance in operation. In addition, development proposals referable to the Mayor should calculate whole life-cycle carbon emissions through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions.

- **Policy SI3 Energy Infrastructure.** This policy recognises that combined heat and power installations can have negative effects on London's air quality and shifts the focus of decentralised energy networks to the use of waste or secondary heat sources, where available. The policy also recognises that, compared to increasingly decarbonised electricity generation, gas-fired heat will become comparatively more carbon intensive as the electricity grid is further decarbonised.

- **Policy SI4 Managing Heat Risk.** This policy sets out the standards that should be used to assess and mitigate overheating risk in new developments. CIBSE TM59 should be used for domestic developments and CIBSE TM52 should be used for non-domestic developments. In addition, CIBSE TM49 guidance and datasets should also be used to ensure that all new development is designed for the climate it will experience over its design life.

4. ENERGY ASSESSMENT

4.1 The energy strategy for the proposed development has been assessed using the Greater London Authority's (GLA) methodology set out in the London Plan and associated documents. This approach is consistent with that required by the London Borough of Camden, and therefore represents best practice in meeting the required standards of energy efficiency and carbon dioxide (CO_2) emissions reduction.

4.2 In line with the GLA London Plan Policy 5.2, the scheme will aim to achieve a minimum 35% carbon dioxide emissions reduction through onsite means. In addition, the residual emissions will be offset to zero via cash in-lieu payment to the London Borough of Camden. As specified by the London Borough of Camden, the carbon offset price of £95 per tonne over 30 years will be employed.

Energy Strategy

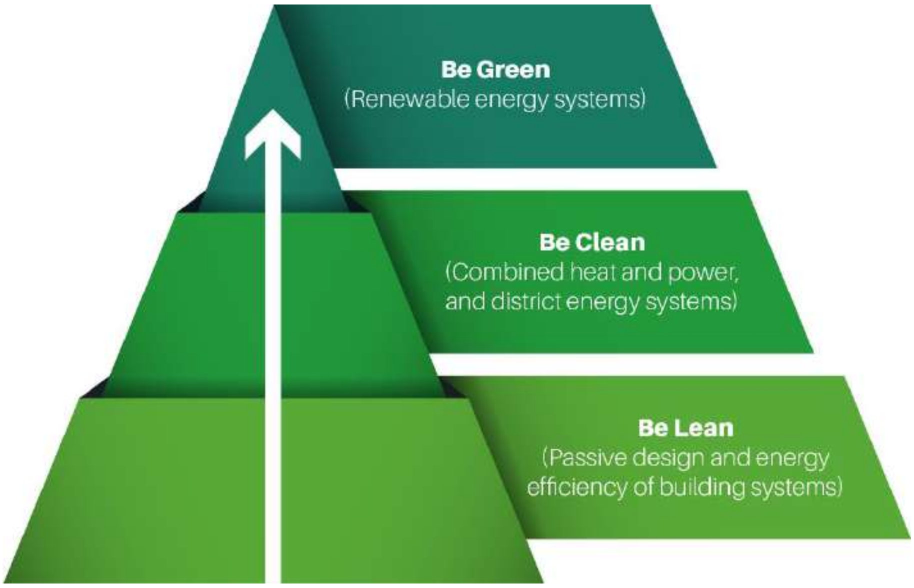
4.3 With reference to the policy requirements, guidance and industry best practice detailed in Section 3, a comprehensive energy and carbon dioxide (CO_2) emissions assessment has been carried out for the proposed development. The energy performance of the scheme has been analysed and evaluated to target a high level of CO_2 emissions performance when assessed against Part L 2013 of the Building Regulations and associated policies, accounting for economic, technical and functional feasibility.

4.4 The proposed energy strategy is based upon the principles of the Energy Hierarchy on the basis that it is preferable to reduce carbon dioxide emissions through reduced energy consumption above decarbonisation through alternative energy sources.

4.5 The tiers of the Energy Hierarchy are:

- Be Lean Use less energy
- Be Clean Supply energy efficiently
- Be Green Use renewable energy

Figure 4.1 The Energy Hierarchy



'Be Lean' (Use Less Energy)

4.6 Within the first stage of the energy hierarchy, it is proposed to incorporate high levels of passive and energy efficient design measures in order to reduce the development's energy consumption and associated CO_2 emissions.

4.7 It is technically possible to exceed Building Regulations requirements (Part L 2013) through demand reduction measures alone and it is an expectation that all applications referred to the Mayor will achieve this.

4.8 The proposed development includes a wide range of energy efficiency measures, intended to reduce energy demand.

4.9 The massing and orientation of the individual dwellings are constrained by the overall masterplan in terms of delivering the required density, preventing overlooking and ensuring daylight and sunlight provision. Despite this, passive design of the apartments includes a number of specific energy efficiency features.

4.10 The following U-values are proposed as a means of limiting heat loss through the apartment building fabric.

Table 4.1 Proposed building fabric U-values

Building Fabric Element	Part L1A:2013 backstop U-values (W/m²K)	Proposed U-values (W/m²K)
Ground floor	0.25	0.10
External wall	0.30	0.15
Roof (with terrace above)	0.20	0.10
Windows	2.00 (including frame)	1.30 (including frame)

4.11 The glazing will be double glazed, argon filled with a low emissivity, solar control coating. Although this has yet to be formally specified, it is expected that window U-values will be 1.3 W/m²K or better (including frame), with a g-value of 0.53 and light transmission of ~75% to improve natural daylight penetration.

4.12 A high level of air tightness is proposed, where a level equal to or below $3m^3/h/m^2$ shall be targeted, meaning that air infiltration between the internal and the external environment will be largely controlled, and space heating/cooling demand further reduced.

4.13 The other significant means of heat loss from dwellings is due to thermal (or cold) bridging. This is typically a construction detail which has higher thermal conductivity than the surrounding materials, creating a path of least resistance for heat transfer. Thermal bridges result in an overall reduction in thermal resistance of the building elements and should be designed out where possible to minimise unwanted heat loss. In order to minimise heat loss through thermal bridges, accredited construction details have been assumed, with an equivalent y-value of 0.05 for each dwelling.

4.14 High efficiency plant, equipment and controls are proposed to limit the energy consumed in order to provide the required level of indoor environmental performance and control. Performance efficiency values were tested and improved in energy models to benchmark the resulting predicted CO_2 reduction.

- Low energy LED lighting will be installed throughout the residential apartments.
- In order to meet the requirements of the GLA's Energy Planning Guidance document under the 'Be Lean' scenario, space and water heating demand within the residential units is served by a communal gas-fired boiler system, with an efficiency of 90%.

- Although residential units are provided with opening windows to mitigate against overheating outside air will be provided via mechanical ventilation with heat recover (MVHR), with a specific fan power of 0.61 W/l/s. A heat exchanger with an efficiency of 86% has also been specified. These efficiencies are higher than those set out in the Domestic Building Services Compliance Guide.

- Energy usage for each apartment will be separately metered to ensure that charging for energy is linked to usage.

- Heating will be controlled via the suitable arrangement of plumbing and electrical services.

4.15 Energy modelling of the proposed scheme has been undertaken using the Standard Assessment Procedure (SAP) for nine of the proposed units, assessing ground, mid- and top floor apartments for each dwelling type. These are shown in the images below, with further details given in Table 4.2.

Figure 4.2 Sample dwellings modelled

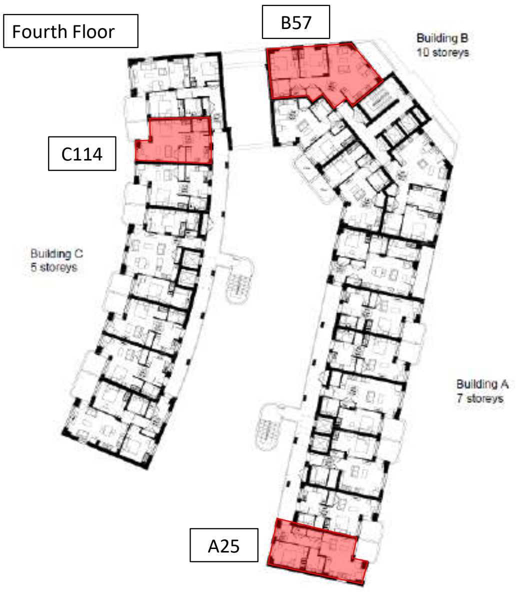


Table 4.2 Sample dwellings modelled

Dwelling Reference	Dwelling Type	Floor	Aspect	Orientation
C84	3B5P	0	Dual	North / West
A08	1B1P	1	Single	East
B44	2B3PW	1	Dual	North East / East
C85	2B4P	1	Triple	East / South / West
A25	1B2P	4	Triple	East / South / West
B57	2B3PW	4	Triple	North / North East / West
C114	1B1P	4	Single	West
B76	2B4P	9	Triple	North East / East / South
B79	1B2P	9	Triple	South / South West / West

4.16 Carbon dioxide emissions results from the apartments detailed above have been extrapolated to match the total number of dwellings proposed, as detailed in Table 4.3 below.

Table 4.3 Dwelling mix

Dwelling Type	Number
1B1P	37
1B2P	39
2B3P	14
2B4P	22
3B5P	1
3B6P	2
Total	**115**

4.17 As outlined in Section 3, the October 2018 update to the GLA Guidance on Energy Assessments encourages the use of SAP 10 carbon emission factors from January 2019 onward. This is due to the significant progress in decarbonising the UK electricity grid since the previous update of Part L in April 2014. The SAP 10 carbon emission factors, which are used within this Energy Assessment, are as follows:

- Natural Gas: 0.210 $kgCO_2$/kWh
- Electricity: 0.233 kg/CO_2/kWh

4.18 Based on the energy analysis of the above dwellings, the total energy demand is shown below.

Table 4.4 Energy demand

Energy demand following energy efficiency measures (kWh/year)					
Space heating	Hot water	Lighting	Auxiliary	Cooling	Unregulated loads
145,391	249,552	29,095	20,381	0	540,846

4.19 The total Part L Fabric Energy Efficiency Standard (FEES) for the development is shown below.

Table 4.5 FEES results

	Target Fabric Energy Efficiency (kWh/year)	Design Fabric Energy Efficiency (kWh/year)	Improvement (%)
Development total	51.78	42.17	19%

4.20 The carbon dioxide emissions for the residential component, under the 'Be Lean' tier of the Energy Hierarchy, and using the SAP 10 carbon emission factors, are shown below. DER and TER worksheets showing the 'Be Lean' performance of each of the sample dwellings modelled are provided in Appendix A2.

Figure 4.3 Carbon dioxide emissions (Be Lean)

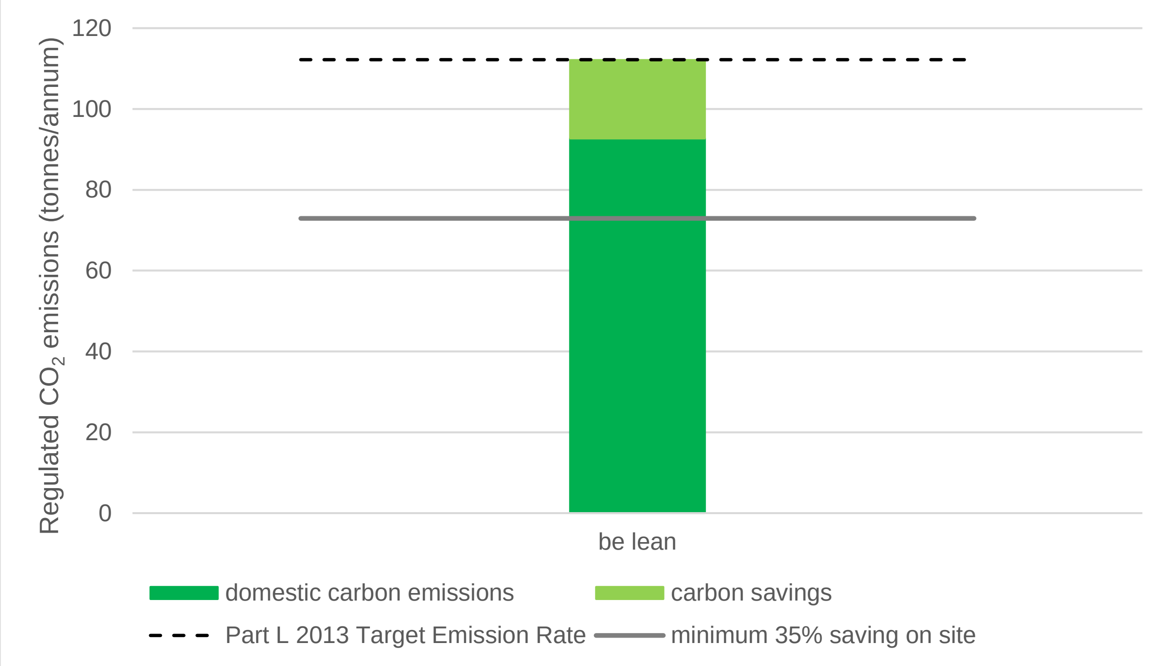


Table 4.6 Carbon dioxide emissions (Be Lean)

TER: Baseline: Part L 2013 Emissions (Tonnes CO_2 per annum)	DER: Proposed 'Be Lean' Emissions (Tonnes CO_2 per annum)	Emissions Savings (Tonnes CO_2 per annum)	Emissions Savings (%)
112.2	94.5	17.7	16%

4.21 The above analysis shows that the domestic element of the proposed development achieves a carbon dioxide emissions saving of 16% through energy efficiency measures alone, under the 'Be Lean' scenario.

‘Be Clean’ (Supply Energy Efficiently)

4.22 The potential for the proposed development to incorporate a low carbon heating/cooling system has been reviewed for the scheme, in line with the hierarchy presented in London Plan policy 5.6, copied below.

1. Connection to existing heating or cooling networks;

2. Site wide combined heat and power (CHP) network; and

3. Communal heating and cooling;

4.23 The London Heat Map is a tool provided by the Mayor of London to identify opportunities for decentralised energy projects in London. It builds on the 2005 London Community Heating Development Study.

4.24 The image below is an extract from the London Heat Map, showing the area in the vicinity of the site. It illustrates;

- Heat demand (areas of heat demand are shown in red, with areas with a high density of heat demand appearing more opaque and areas of zero heat demand appearing transparent);
- Existing heat networks (shown as red lines);
- Proposed heat networks (shown as orange lines);
- Proposed heat networks (GLA PB Power 2005 study; shown as purple lines);
- Heatmap study areas (shown as transparent white circles); and
- Potential heat supply sites (shown as red dots).

Figure 4.5 Extract from the London heat map

4.25 The extract above indicates that the proposed development site is located within an area of low heat density. Whilst the proposed site is shown to fall within a Heat Network Priority Area, and despite having been identified as a potential heat supply site within the Borough Wide Heat Demand and Heat Source Mapping: London Borough of Camden report prepared by Buro Happold in May 2015, Figure 4.5 above indicates that there are neither any existing nor planned heat networks within proximity to the proposed development site. Based on this, the opportunity for the proposed development to connect to a local heat network at this time is limited.

4.26 Furthermore, following correspondence with LBC's Senior Sustainability Officer (Appendix A3), it has been confirmed that there are no detailed plans for a proposed Kentish Town Network at present. It has been highlighted, however, that this area is of interest with regards to the provision of a district heat network, particularly when considering the density of Camden housing to the north of the proposed development site. It has therefore been advised that, in order to ensure the proposed development is future-proofed, measures to facilitate connection to a district heat network in the future should be considered. Measures to facilitate connection to a wider district heat network will therefore be provided as part of the mechanical services design.

4.27 The use of CHP is also considered to be unviable for the proposed site, based on the most up-to-date GLA energy guidance, which looks to move away from the use of natural gas to meet space and water heating demands. It is therefore recommended that a communal air source heat pump (ASHP) system is employed to service the development. The incorporation of heat pump technology is discussed in greater detail in the 'Be Green' section.

'Be Green' (Utilise Renewable Technologies)

4.28 A full review of potentially applicable renewable technologies has been carried out, considering both the effectiveness and viability of the different technologies. Full details of the assessment and outcomes are provided in Appendix A4.

4.29 Given the site location, lack of local existing or proposed heat networks, and the GLA's requirement to use the draft SAP 10 carbon factors, it is proposed that air source heat pump (ASHP) technology is employed to serve the heating and hot water demands of the residential elements.

4.30 It is intended that a highly efficient, communal air source heat pump (ASHP) system will be employed to serve both the space and water heating demand. Typical manufacturer specifications for the proposed system quote a heating and hot water coefficient of performance of 3.19 at a supply temperature of 55degC.. Whilst the specified system operates quietly, as the design progresses, acoustic measures to further limit the noise generated by the outside unit of the system during operation will be considered.

4.31 More details on the proposed system are provided in Appendix A4. The ASHP is an approved product on the Microgeneration Certification Scheme and qualifies for the enhanced capital allowances Energy Technology List.

4.32 Detailed pipework design is currently being developed and as such it has not yet been possible to calculate precise details of heat losses from pipework. As a worst-case scenario, a 25% loss factor has been applied when undertaking the carbon dioxide emissions calculations for the 'Be Green' stage.

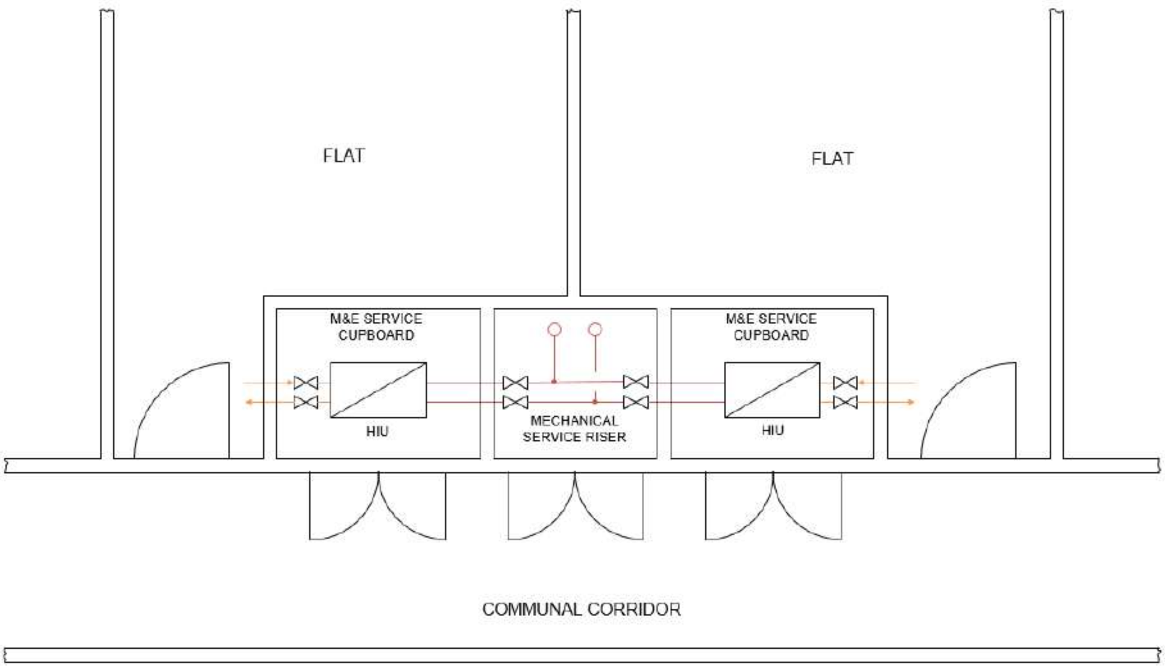
4.33 Plant space has been allocated at the ground-floor level, as shown in Figure 4.6 as well as at the roof-level of Block B, as shown in Figure 4.7.

Figure 4.6 Proposed ground-level plant space allocation

Figure 4.7 Proposed roof-level plant space allocation

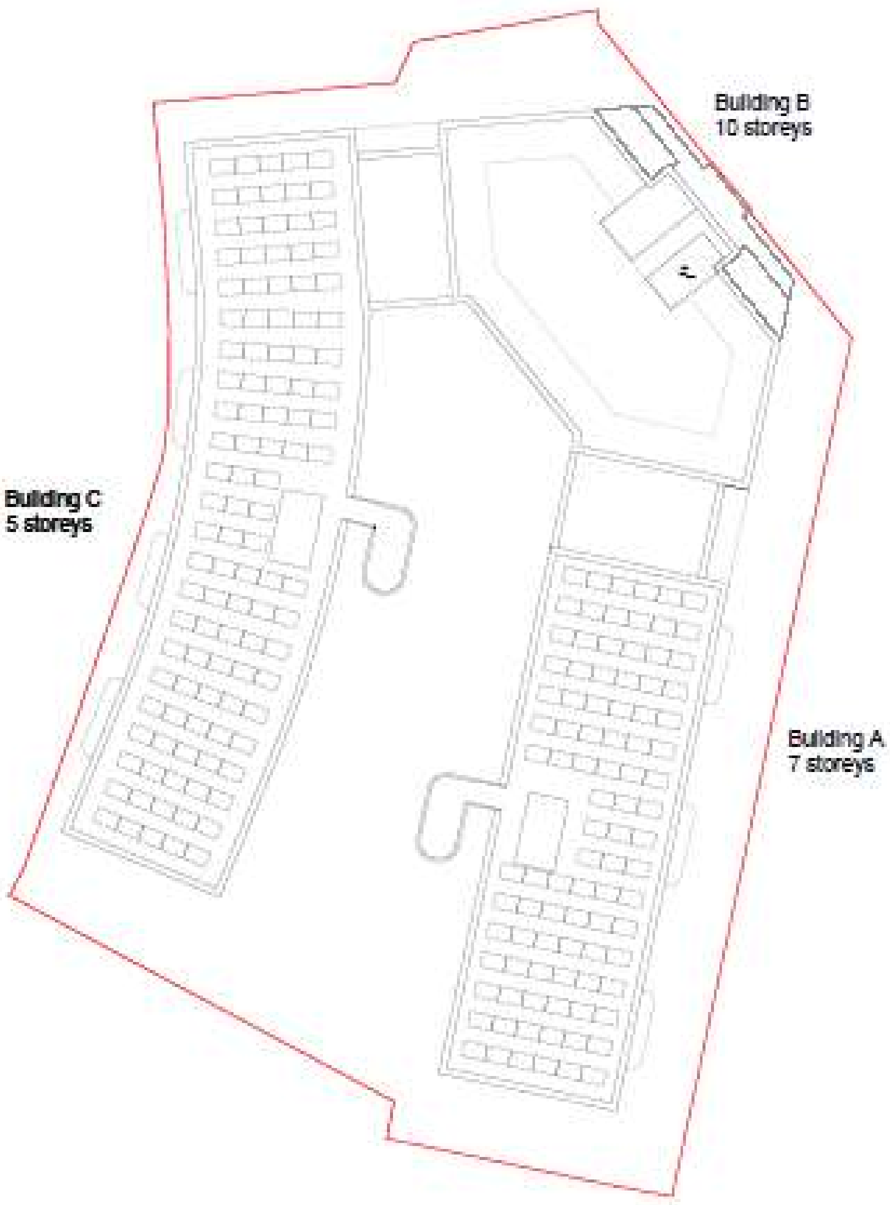
4.34 Heat will be supplied to individual units via heating interface units (HIUs). In order to facilitate ease of monitoring of site-wide energy usage, a site-wide hard wired heat metering network will connect all units back to the plant rooms.

Figure 4.8 Sample residential HIU location



4.35 It is also proposed that an array of photovoltaic (PV) panels be employed to provide carbon-free electricity to the development. The locations of the proposed arrays are highlighted on the roof plan displayed below, based on the drawings produced by HTA Architects. It should be noted that this plan is indicative at this stage, and demonstrates the proposed location of the PV arrays. These areas, on the flat roofs of Blocks A and C, have been selected to be free from overshading from neighbouring buildings, and rooftop lift overruns. The location of the proposed arrays also takes into account the space required to house the plant associated with the proposed communal ASHP system, which is to be located on the flat roof of Block B.

Figure 4.6 Proposed rooftop PV panel locations



4.36 The areas proposed for the PV arrays, as indicated on the above plan, have been maximised based on the available roof space when taking the requirements for plant space into account. Based on the configuration set out above, is proposed that the highlighted roof area will house 202 PV panels. The PV coverage extends to all reasonably available roof space that is unshaded and not used by building plant. Standard PV panels have been assumed with an efficiency of ~15% and a dimension of 0.9 x

1.6m, providing approximately 250 W per panel (peak output). Panels will be oriented at 15° to the horizontal and face due south to maximise output per panel.

4.37 It is estimated that the 202 PV panels will produce an average of 42,925 kWh of renewable electricity per year, equating to a carbon dioxide saving of 10.0 tonnes of CO_2 per year using the SAP 10 electricity emissions factor of 0.233 kgCO_2/kWh.

4.38 The domestic 'Be Green' energy analysis was carried out on the same dwellings as indicated in Figure 4.2, above.

4.39 The carbon dioxide emissions for the residential component, under the 'Be Green' tier of the Energy Hierarchy is shown below. DER and TER worksheets showing the 'Be Green' performance of each of the dwellings modelled are provided in Appendix A2.

Figure 4.7 Domestic carbon dioxide emissions (Be Green)

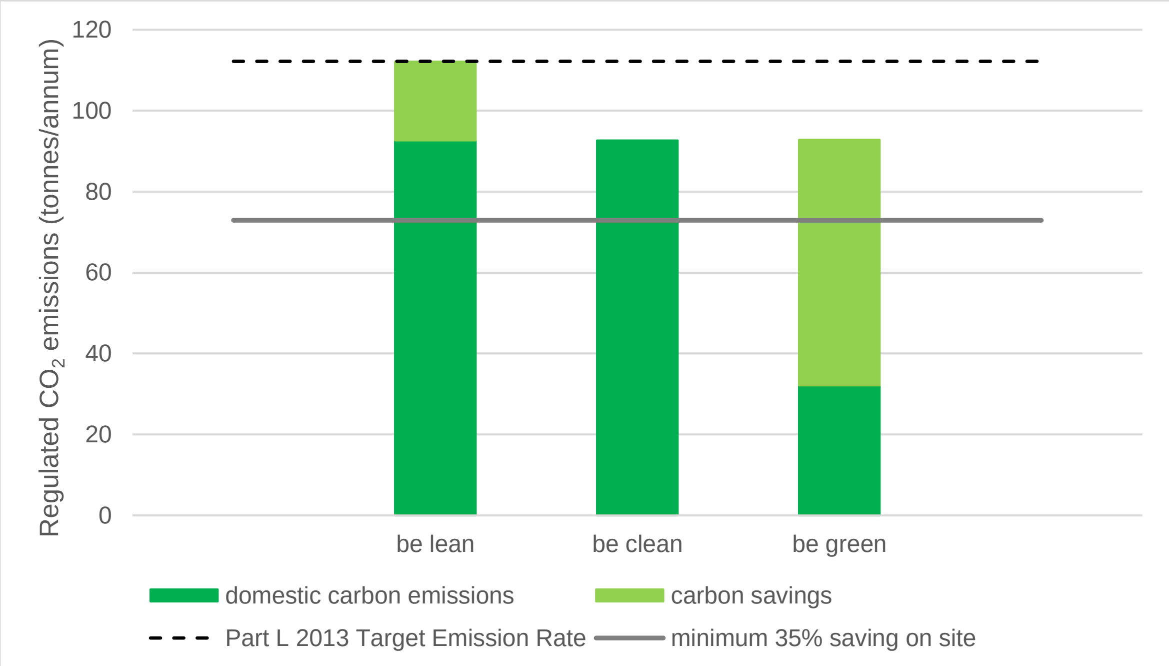


Table 4.7 Domestic carbon dioxide emissions (Be Green)

TER: Baseline: Part L 2013 Emissions (Tonnes CO_2 per annum)	DER: Proposed 'Be Green' Emissions (Tonnes CO_2 per annum)	Cumulative Emissions Savings (Tonnes CO_2 per annum)	Cumulative Emissions Savings (%)
112.2	32.7	79.4	71%

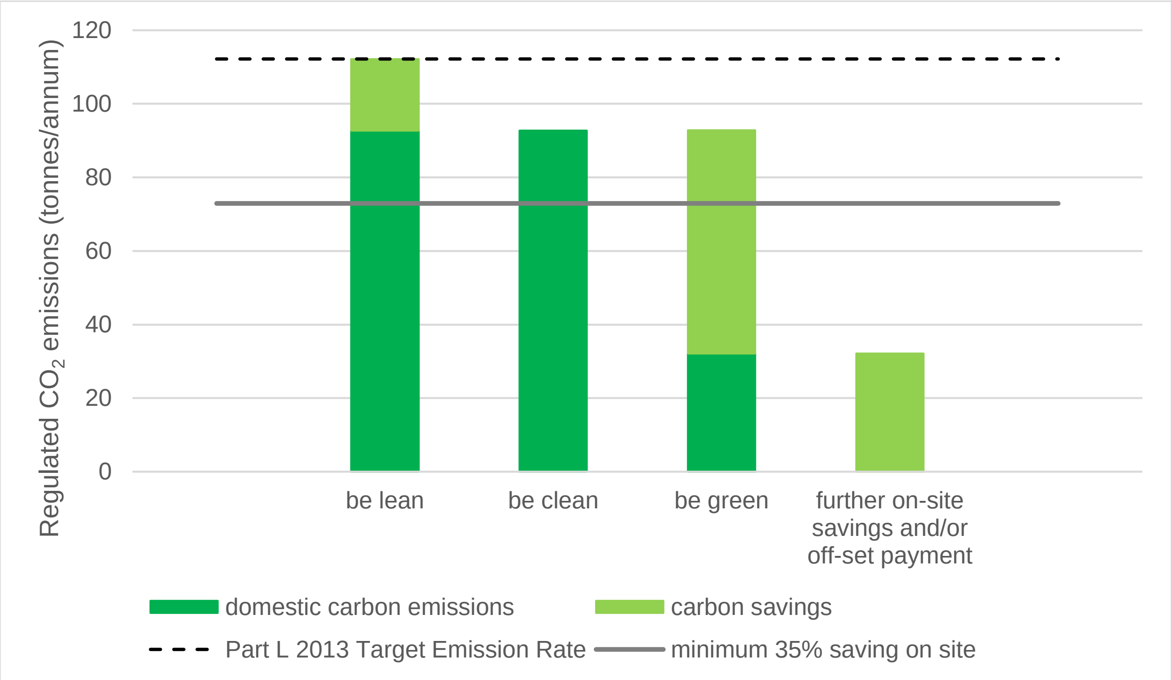
4.40 The above analysis shows that the domestic element of the proposed development achieves a carbon dioxide emissions saving of 71% through energy efficiency measures and renewable technologies, under the 'Be Green' scenario.

Carbon Offsetting

4.41 As per the requirements of London Plan policy 5.2, new build residential buildings are expected to meet a zero-carbon target. Where the residential component of a development is unable to meet the zero-carbon target through on-site means alone, the remaining regulated carbon dioxide emissions, to 100%, are to be offset through a cash in lieu contribution to local authorities to be ringfenced to secure delivery of carbon dioxide savings elsewhere.

4.42 Based on the information presented in Table 4.7 above, a total of 982 tonnes of residual carbon dioxide are required to be offset from the proposed development over a period of 30 years. The established LBC price for carbon dioxide of £95 per tonne has been applied over a 30-year period to calculate the offsetting cost. The 982 tonnes therefore result in an offset cost of £93,324.

Figure 4.9 Carbon dioxide emissions after offsetting



Cooling and Overheating

4.43 The design of the dwellings has been developed in line with the GLA's recommended 'Cooling Hierarchy' approach, detailed in London Plan policy 5.9. This applies a similar principle to the thorough decision-making process of the Energy Hierarchy, with the aim of reducing CO_2 emissions from cooling and minimising the risk of overheating where no cooling is present:

Minimisation of internal heat generation through energy efficient design

- Heat gain from lighting is kept to a minimum as a result of an energy-efficient lighting design solution.
- The availability of natural light is maximised by optimising the light transmittance of the glass elements of the façade.
- Heat distribution pipework in communal areas of the residential component will be designed to minimise heat loss.
- HIUs will be positioned in apartments adjacent to corridors and risers to minimise pipework runs within apartments.
- The scheme will use a communal air source heat pump, which is a low temperature distribution system, leading to lower internal heat gains from distribution pipework.

Reduction of the amount of heat entering the building in summer

- The building's façades have a limited amount of glazing to mitigate direct solar heat gain while optimising daylight penetration.
- Façade glazing will use solar control glass to reduce solar gains entering dwellings
- The use of inset balconies and blinds will provide solar shading to apartments, although the overheating mitigation strategy is not dependent on the use of blinds.

Management of the heat within the building through exposed thermal mass and high ceilings

- The proposed green roofs will have a high degree of in-built thermal mass to mitigate heat gain and heat loss.

Passive ventilation

- Openable windows on multiple aspect apartments will provide a passive ventilation strategy that utilises crossflow ventilation to maximise the potential for natural ventilation within the scheme.
- Single aspect dwellings will also have multiple openable windows throughout the façade to provide passive ventilation.

Mechanical and active cooling

- Cooling is not proposed.

4.44 The following table reports responses to Section 1 of the GLA's overheating checklist, intended to provide guidance on determining potential residential overheating risk.

Table 4.8 Site features affecting vulnerability to overheating

Section 1 – Site features affecting vulnerability to overheating		Yes or No
Site location	Urban – within central London or in a high-density conurbation	Yes
	Peri-urban – on the suburban fringes of London	No
Air quality and/or Noise sensitivity – are any of the following in the vicinity of the buildings?	Busy roads / A roads	No
	Railways / Overground / DLR	No
	Airport / Flight path	No
	Industrial uses / Waste facility	No
Proposed building use	Will any buildings be occupied by vulnerable people (e.g. elderly, disabled, young children)?	Potentially
	Are residents likely to be at home during the day?	Potentially
Dwelling aspect	Are there any single aspect units?	Yes
Glazing ratio	Is the glazing ratio (glazing: internal floor area) greater than 25%?	Typically 20-30%
	If yes, is this to allow acceptable levels of daylighting?	Yes
Security – Are there any security issues that could limit opening of windows for ventilation?	Single storey ground floor units	Yes
	Vulnerable areas identified by the Police Architectural Liaison Officer	TBC
	Other	TBC

4.45 Section 2 of the GLA's overheating checklist is provided below.

Table 4.9 Site features affecting vulnerability to overheating

Section 2 – Design features implemented to mitigate overheating risk		Yes or No
Landscaping	Will deciduous trees be provided for summer shading (to windows and pedestrian routes)?	No
	Will green roofs be provided?	Yes
	Will other green or blue infrastructure be provided around buildings for evaporative cooling?	Yes
Materials	Have high albedo (light colour) materials been specified?	Yes
Dwelling aspect	% of total units that are single aspect	7%
	% of single aspect with N / NE / NW orientation	0%
	% of single aspect with E orientation	0%
	% of single aspect with S / SE / SW orientation	100%
	% of single aspect with W orientation	0%
Daylighting	What is the average daylight factor range?	Scheme will target BRE ADF levels:
Window opening	Are the windows openable	Yes
Window opening	What is the average percentage openable area for the windows?	26-89%
Window opening – What is the extent of the opening	Fully openable	Variable

	Limited (e.g. for security, safety, wind loading reasons)	Limited for safety where appropriate
Security	Where there are security issues (e.g. ground floor flats) has an alternative night time natural ventilation method been provided (e.g. ventilation grates)?	Ventilation grates provided if necessary
Shading	Is there any external shading?	Yes – inset balconies
	Is there any internal shading?	Yes – blinds
Glazing specification	Is there any solar control glazing?	Yes to limit g-value to 0.53
Ventilation – What is the ventilation strategy?	Natural – background	No
	Natural – purge	Yes – opening windows
	Mechanical – background	MVHR specified
	Mechanical – purge	No
	What is the average design air change rate?	~1.5 ach
Heating system	Is communal heating present?	Yes
	What is the flow/return temperature?	65°C/60°C
	Have horizontal pipe runs been minimised?	TBC following detailed design
	Do the specifications include insulation levels in line with the London Heat Network Manual?	TBC following detailed design

4.46 An overheating assessment of a sample of eight of the residential apartments has been carried out using dynamic thermal modelling. This assessment has employed the guidance set out in CIBSE TM59 to reliably model overheating in residential properties. The overheating assessment made use of the Design Summer Years for London specified in CIBSE TM49 to predict overheating risk for three different weather scenarios.

- DSY1. 1989: a moderately warm summer (current design year for London).
- DSY2. 1976: a year with a prolonged period of sustained warmth.
- DSY3. 2003: a year with a very intense single warm spell.

4.47 To account for the urban heat island effect in the locality of the development, weather data from the London Weather Centre has been employed as the basis for the analysis, as this location most closely matches Camden as a higher density urban area.

4.48 The risk of overheating has been assessed using the guidance contained in CIBSE TM52, which details the limits of thermal comfort.

4.49 Full details of the overheating assessment are provided in Appendix A5, and a summary is given below.

4.50 All dwellings pass the TM59 overheating criteria for the DSY1 and DSY3 weather files. For the DSY2 scenario, failures are predicted for two of the eight bedrooms tested. However, the extent of the failure is not significant, with a 1.3% exceedance of target temperatures, compared with the guidance target exceedance of 1.0%.

4.51 If overheating was found to be an issue in future for these dwellings, the following mitigation measures should be explored:

- Retrofitted solar control film to minimise solar gain
- Additional external shading to limit solar gain
- Improved blinds to reduce solar gain
- Increased MVHR flow rates for additional purge ventilation
- Use of free standing fans
- Ventilation grilles for ground floor dwellings

5. SUMMARY AND CONCLUSIONS

5.1 This Energy Statement provides an overview as to how the proposed development at Belmont Street contributes to achieve CO_2 emissions reduction and gives an overview of the design proposals that will ensure the development operates in an energy efficient manner over the lifespan of the scheme.

5.2 Section 4 of this statement demonstrates that the siting and design of the proposals support relevant policy relating to energy guidelines set out by the Greater London Authority and the London Borough of Camden.

5.3 The energy assessment has shown that the proposed development will adopt the Mayor of London's 'Energy Hierarchy' and the proposed strategy shall achieve a 71% reduction in carbon dioxide emissions through on-site means alone.

5.4 The measures proposed at each level of the Energy Hierarchy are set out below.

5.5 The proposed 'Be Lean' measures include:

- High levels of building fabric insulation to minimise heat loss
- A balanced proportion of façade glazing to ensure natural daylight provision without increasing overheating risk
- High levels of air tightness to reduce heat loss through infiltration
- The use of accredited construction details to minimise heat loss through thermal bridging
- Low energy LED lighting to minimise artificial lighting energy consumption
- Mechanical ventilation with heat recovery to provide fresh air, with heat recovered from extract air
- A high specification of heating controls to ensure operational efficiency

5.6 The 'Be Green' measures include:

- Employment of a highly efficient, communal air source heat pump (ASHP) system
- 202 roof-top PV panels to provide renewable energy

5.7 The level of site-wide emissions reduction achieved for each stage of the Energy Hierarchy is shown below.

Figure 5.1 Site-wide regulated carbon dioxide emissions and savings

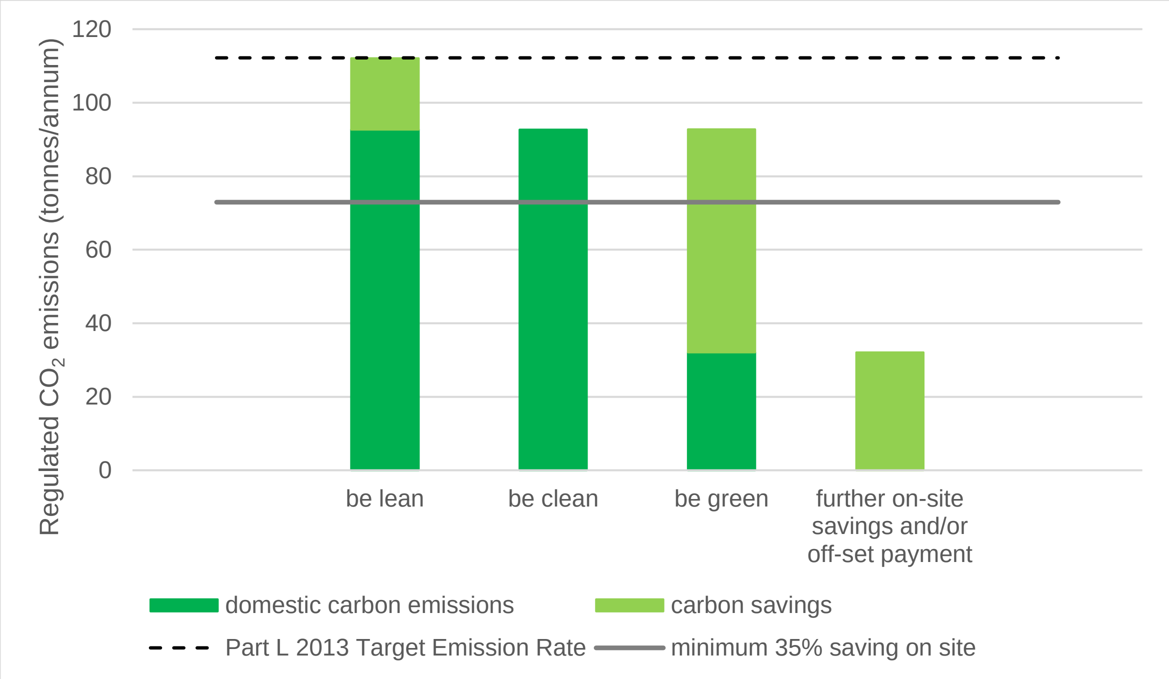


Table 5.1 Site-wide carbon dioxide emissions after each stage of the Energy Hierarchy

	Site-wide carbon dioxide emissions (Tonnes CO_2 per annum)	
	Regulated	**Unregulated**
Baseline: Part L 2013 of the Building Regulations Compliant Development	112.2	114.4
After energy demand reduction	94.5	114.4
After renewable energy	32.7	114.4

Table 5.2 Site-wide regulated carbon dioxide emissions after each stage of the Energy Hierarchy

	Regulated domestic carbon dioxide savings	
	(Tonnes CO_2 per annum)	(%)
Savings from energy demand reduction	17.7	16%
Savings from renewable energy	61.7	55%
Cumulative on-site savings	79.4	71%
Annual savings from offset payment (residential element)	32.7	
	(Tonnes CO_2)	
Cumulative savings for offset payment	982	
Cash in-lieu contribution	£93,324	

5.8 The assessment concludes that the proposals have maximised all available opportunities for on-site regulated carbon emissions reduction. The proposed energy strategy achieves an on-site emissions reduction of 71%. 982 tonnes of CO_2 per annum of residential emissions from the development are proposed to be offset through a cash-in-lieu contribution.

5.9 Overall, the proposals for the scheme are in line with the policy requirements of the planning authority for energy statements and will provide a development that seeks to promote these principles in operation.

A1. SITE PLAN

Rev	Date	Drawn	Description
I	11.08.20	ALE	Issued for Planning

Notes:
Do not scale from drawings unless by agreement with HTA. Use figured dimensions only. Check all dimensions on site prior to commencing the works. Drawing to be read in conjunction with other relevant consultant information.

Drawing to be read in conjunction with specification.

Legend

Proposed Ground Floor Plan
drawing title

CHA-HTA-A-0100
drawing number

I
revision

Vistry Partnerships
Belmont Street Site, Camden
client / project

Scale 1:200
scale @ A1

GAL-CHA
project number

ALE
originated by

HTA Design LLP
www.hta.co.uk
London | Edinburgh | Manchester | Bristol

FOR PLANNING
status

A2. DER/TER WORKSHEETS

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: C84_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.5	(1a) x	2.8	(2a) =	343	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	343	(5)

2. Ventilation rate:

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

DRAFT

			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 *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*		0	(11)
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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0.5	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	76.5	(23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.3	=	2.73			(26)
Doors Type 2			4	x	1.3	=	5.2			(26)
Doors Type 3			2.3	x	1	=	2.3			(26)
Windows Type 1			3.2	x1/[1/(1.3)+ 0.04]		=	3.95			(27)
Windows Type 2			1.9	x1/[1/(1.3)+ 0.04]		=	2.35			(27)
Windows Type 3			4.3	x1/[1/(1.3)+ 0.04]		=	5.31			(27)
Windows Type 4			4	x1/[1/(1.3)+ 0.04]		=	4.94			(27)
Windows Type 5			3.3	x1/[1/(1.3)+ 0.04]		=	4.08			(27)
Windows Type 6			3.3	x1/[1/(1.3)+ 0.04]		=	4.08			(27)
Windows Type 7			1.3	x1/[1/(1.3)+ 0.04]		=	1.61			(27)
Floor			122.5	x	0.1	=	12.25			(28)
Walls	78.96	29.7	49.26	x	0.15	=	7.39			(29)
Total area of elements, m²			201.46							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	56.19	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	22834.4	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K	10.07	(36)

DER WorkSheet: New dwelling design stage

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

Total fabric heat loss (33) + (36) = 66.26 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.7	31.34	30.98	29.17	28.81	27.01	27.01	26.65	27.73	28.81	29.54	30.26	(38)

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

(39)m=	97.96	97.6	97.24	95.43	95.07	93.27	93.27	92.91	93.99	95.07	95.8	96.52	

Average = Sum(39)$_{1\ldots12}$ /12= 95.34 (39)

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

(40)m=	0.8	0.8	0.79	0.78	0.78	0.76	0.76	0.76	0.77	0.78	0.78	0.79	

Average = Sum(40)$_{1\ldots12}$ /12= 0.78 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.42 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.66	108.57	104.47	100.37	96.28	92.18	92.18	96.28	100.37	104.47	108.57	112.66	

Total = Sum(44)$_{1\ldots12}$ = 1229.06 (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=	167.08	146.13	150.79	131.46	126.14	108.85	100.87	115.74	117.13	136.5	149	161.8	

Total = Sum(45)$_{1\ldots12}$ = 1611.49 (45)

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

(46)m=	25.06	21.92	22.62	19.72	18.92	16.33	15.13	17.36	17.57	20.48	22.35	24.27	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	222.35	196.05	206.07	184.96	181.42	162.34	156.14	171.02	170.62	191.78	202.49	217.08	(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=	222.35	196.05	206.07	184.96	181.42	162.34	156.14	171.02	170.62	191.78	202.49	217.08	

Output from water heater (annual)$_{1\ldots12}$ — 2262.33 (64)

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

(65)m=	99.77	88.53	94.36	86.51	86.16	78.99	77.76	82.71	81.74	89.61	92.34	98.02	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	(66)

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

(67)m=	25.71	22.84	18.57	14.06	10.51	8.87	9.59	12.46	16.73	21.24	24.79	26.43	(67)

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

(68)m=	288.43	291.43	283.88	267.83	247.56	228.51	215.78	212.79	220.33	236.39	256.66	275.71	(68)

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

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(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=	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	(71)

Water heating gains (Table 5)

(72)m=	134.11	131.74	126.83	120.15	115.81	109.7	104.52	111.16	113.53	120.44	128.25	131.75	(72)

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

(73)m=	514.34	512.09	495.37	468.12	439.97	413.17	395.97	402.5	416.67	444.16	475.78	499.97	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.63	x	0.53	x	0.7	=	8.75	(74)
North	0.9x	0.77	x	1.9	x	10.63	x	0.53	x	0.7	=	5.19	(74)
North	0.9x	0.77	x	4.3	x	10.63	x	0.53	x	0.7	=	11.76	(74)
North	0.9x	0.77	x	4	x	10.63	x	0.53	x	0.7	=	10.94	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.53	x	0.7	=	9.02	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.53	x	0.7	=	9.02	(74)
North	0.9x	0.77	x	1.3	x	10.63	x	0.53	x	0.7	=	3.55	(74)
North	0.9x	0.77	x	3.2	x	20.32	x	0.53	x	0.7	=	16.72	(74)
North	0.9x	0.77	x	1.9	x	20.32	x	0.53	x	0.7	=	9.93	(74)
North	0.9x	0.77	x	4.3	x	20.32	x	0.53	x	0.7	=	22.47	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.53	x	0.7	=	20.9	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.53	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.53	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.53	x	0.7	=	6.79	(74)
North	0.9x	0.77	x	3.2	x	34.53	x	0.53	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	1.9	x	34.53	x	0.53	x	0.7	=	16.87	(74)
North	0.9x	0.77	x	4.3	x	34.53	x	0.53	x	0.7	=	38.17	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.53	x	0.7	=	35.51	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.53	x	0.7	=	29.3	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.53	x	0.7	=	29.3	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.53	x	0.7	=	11.54	(74)
North	0.9x	0.77	x	3.2	x	55.46	x	0.53	x	0.7	=	45.63	(74)
North	0.9x	0.77	x	1.9	x	55.46	x	0.53	x	0.7	=	27.09	(74)
North	0.9x	0.77	x	4.3	x	55.46	x	0.53	x	0.7	=	61.32	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.53	x	0.7	=	57.04	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.53	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.53	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.53	x	0.7	=	18.54	(74)
North	0.9x	0.77	x	3.2	x	74.72	x	0.53	x	0.7	=	61.47	(74)
North	0.9x	0.77	x	1.9	x	74.72	x	0.53	x	0.7	=	36.5	(74)
North	0.9x	0.77	x	4.3	x	74.72	x	0.53	x	0.7	=	82.6	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.53	x	0.7	=	76.84	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.53	x	0.7	=	63.39	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.53	x	0.7	=	63.39	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.53	x	0.7	=	24.97	(74)
North	0.9x	0.77	x	3.2	x	79.99	x	0.53	x	0.7	=	65.81	(74)
North	0.9x	0.77	x	1.9	x	79.99	x	0.53	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	4.3	x	79.99	x	0.53	x	0.7	=	88.43	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.53	x	0.7	=	82.26	(74)

North	0.9x	0.77	x	3.3	x	79.99	x	0.53	x	0.7	=	67.86	(74)
North	0.9x	0.77	x	3.3	x	79.99	x	0.53	x	0.7	=	67.86	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.53	x	0.7	=	26.73	(74)
North	0.9x	0.77	x	3.2	x	74.68	x	0.53	x	0.7	=	61.44	(74)
North	0.9x	0.77	x	1.9	x	74.68	x	0.53	x	0.7	=	36.48	(74)
North	0.9x	0.77	x	4.3	x	74.68	x	0.53	x	0.7	=	82.56	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.53	x	0.7	=	76.8	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.53	x	0.7	=	63.36	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.53	x	0.7	=	63.36	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.53	x	0.7	=	24.96	(74)
North	0.9x	0.77	x	3.2	x	59.25	x	0.53	x	0.7	=	48.74	(74)
North	0.9x	0.77	x	1.9	x	59.25	x	0.53	x	0.7	=	28.94	(74)
North	0.9x	0.77	x	4.3	x	59.25	x	0.53	x	0.7	=	65.5	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.53	x	0.7	=	60.93	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.53	x	0.7	=	50.27	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.53	x	0.7	=	50.27	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.53	x	0.7	=	19.8	(74)
North	0.9x	0.77	x	3.2	x	41.52	x	0.53	x	0.7	=	34.16	(74)
North	0.9x	0.77	x	1.9	x	41.52	x	0.53	x	0.7	=	20.28	(74)
North	0.9x	0.77	x	4.3	x	41.52	x	0.53	x	0.7	=	45.9	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.53	x	0.7	=	42.7	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.53	x	0.7	=	35.22	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.53	x	0.7	=	35.22	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.53	x	0.7	=	13.88	(74)
North	0.9x	0.77	x	3.2	x	24.19	x	0.53	x	0.7	=	19.9	(74)
North	0.9x	0.77	x	1.9	x	24.19	x	0.53	x	0.7	=	11.82	(74)
North	0.9x	0.77	x	4.3	x	24.19	x	0.53	x	0.7	=	26.74	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.53	x	0.7	=	24.88	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.53	x	0.7	=	20.52	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.53	x	0.7	=	20.52	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.53	x	0.7	=	8.08	(74)
North	0.9x	0.77	x	3.2	x	13.12	x	0.53	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	1.9	x	13.12	x	0.53	x	0.7	=	6.41	(74)
North	0.9x	0.77	x	4.3	x	13.12	x	0.53	x	0.7	=	14.5	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.53	x	0.7	=	13.49	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.53	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.53	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.53	x	0.7	=	4.38	(74)
North	0.9x	0.77	x	3.2	x	8.86	x	0.53	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	1.9	x	8.86	x	0.53	x	0.7	=	4.33	(74)
North	0.9x	0.77	x	4.3	x	8.86	x	0.53	x	0.7	=	9.8	(74)

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North	0.9x	0.77	x	4	x	8.86	x	0.53	x	0.7	=	9.12	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.53	x	0.7	=	7.52	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.53	x	0.7	=	7.52	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.53	x	0.7	=	2.96	(74)

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

(83)m=	58.23	111.28	189.1	303.74	409.17	438.02	408.95	324.45	227.36	132.47	71.84	48.54	(83)

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

(84)m=	572.57	623.37	684.47	771.86	849.13	851.2	804.92	726.95	644.03	576.62	547.62	548.52	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.89	0.68	0.51	0.58	0.88	0.99	1	1	(86)

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

(87)m=	20.13	20.22	20.4	20.67	20.9	20.99	21	21	20.93	20.66	20.36	20.12	(87)

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

(88)m=	20.25	20.26	20.26	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.27	20.26	(88)

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

(89)m=	1	1	0.99	0.97	0.86	0.61	0.43	0.5	0.83	0.99	1	1	(89)

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

(90)m=	19.07	19.2	19.47	19.87	20.17	20.28	20.29	20.29	20.22	19.85	19.41	19.06	(90)

fLA = Living area ÷ (4) = 0.4 (91)

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

(92)m=	19.49	19.61	19.85	20.19	20.46	20.56	20.57	20.57	20.51	20.17	19.79	19.49	(92)

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

(93)m=	19.49	19.61	19.85	20.19	20.46	20.56	20.57	20.57	20.51	20.17	19.79	19.49	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.87	0.64	0.46	0.53	0.84	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	572.03	622.17	680.35	748.62	735.22	546.44	369.74	385.63	543.77	567.6	546.41	548.13	(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=	1488.36	1436.11	1297.7	1077.55	832.89	556.23	370.56	387.73	602.31	910.3	1215.6	1475.33	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	681.74	546.96	459.31	236.83	72.67	0	0	0	0	254.97	481.82	689.84	

Total per year (kWh/year) = Sum(98)1…5,9…12 = 3424.15 (98)

Space heating requirement in kWh/m²/year 27.95 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3424.15	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	3595.36	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2262.33	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2375.44	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	59.71	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		319.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	319.08	(331)
Energy for lighting (calculated in Appendix L)		454.09	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1432.99	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	30.99	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1463.98	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1463.98	(376)

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CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	165.6	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	235.67	(379)
Total CO2, kg/year	sum of (376)…(382) =			1865.25	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.23	(384)
EI rating (section 14)				85.08	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: C84_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.5	(1a) x	2.8	(2a) =	343	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	343	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40	÷ (5) =	0.12	(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)	0.37	(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) =	0.31	(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

0.4	0.39	0.38	0.34	0.33	0.3	0.3	0.29	0.31	0.33	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

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

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.2	=	2.52			(26)
Doors Type 2			4	x	1.2	=	4.8			(26)
Doors Type 3			2.3	x	1	=	2.3			(26)
Windows Type 1			3.2	x1/[1/(1.4)+ 0.04]		=	4.24			(27)
Windows Type 2			1.9	x1/[1/(1.4)+ 0.04]		=	2.52			(27)
Windows Type 3			4.3	x1/[1/(1.4)+ 0.04]		=	5.7			(27)
Windows Type 4			4	x1/[1/(1.4)+ 0.04]		=	5.3			(27)
Windows Type 5			3.3	x1/[1/(1.4)+ 0.04]		=	4.37			(27)
Windows Type 6			3.3	x1/[1/(1.4)+ 0.04]		=	4.37			(27)
Windows Type 7			1.3	x1/[1/(1.4)+ 0.04]		=	1.72			(27)
Floor			122.5	x	0.13	=	15.925			(28)
Walls	78.96	29.7	49.26	x	0.18	=	8.87			(29)
Total area of elements, m²			201.46							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 62.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 22834.4 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.07 (36)

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

Total fabric heat loss	(33) + (36) =	72.72	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	65.53	65.18	64.84	63.25	62.95	61.56	61.56	61.3	62.09	62.95	63.55	64.18	(38)

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

(39)m=	138.25	137.9	137.56	135.97	135.67	134.28	134.28	134.02	134.81	135.67	136.27	136.9	

Average = Sum(39)$_{1\ldots12}$ /12= 135.96 (39)

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

(40)m=	1.13	1.13	1.12	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1\ldots12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.42 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.66	108.57	104.47	100.37	96.28	92.18	92.18	96.28	100.37	104.47	108.57	112.66	

Total = Sum(44)$_{1\ldots12}$ = 1229.06 (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=	167.08	146.13	150.79	131.46	126.14	108.85	100.87	115.74	117.13	136.5	149	161.8	

Total = Sum(45)$_{1\ldots12}$ = 1611.49 (45)

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

(46)m=	25.06	21.92	22.62	19.72	18.92	16.33	15.13	17.36	17.57	20.48	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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):		1.39	(48)
Temperature factor from Table 2b		0.54	(49)
Energy lost from water storage, kWh/year	(48) x (49) =	0.75	(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)		0.75	(55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4	(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=	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4

Output from water heater (annual)1…12 | 2160.1 | (64)

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

(65)m=	92.83	82.26	87.41	79.78	79.22	72.27	70.81	75.76	75.02	82.66	85.62	91.08	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	(66)

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

(67)m=	25.71	22.84	18.57	14.06	10.51	8.87	9.59	12.46	16.73	21.24	24.79	26.43	(67)

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

(68)m=	288.43	291.43	283.88	267.83	247.56	228.51	215.78	212.79	220.33	236.39	256.66	275.71	(68)

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

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	(71)

Water heating gains (Table 5)

(72)m=	124.77	122.4	117.49	110.81	106.48	100.37	95.18	101.83	104.19	111.11	118.91	122.41	(72)

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

(73)m=	508	505.76	489.03	461.79	433.63	406.84	389.64	396.17	410.34	437.82	469.45	493.63	(73)

6. Solar gains:

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

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.63	x	0.63	x	0.7	=	10.4	(74)
North	0.9x	0.77	x	1.9	x	10.63	x	0.63	x	0.7	=	6.17	(74)
North	0.9x	0.77	x	4.3	x	10.63	x	0.63	x	0.7	=	13.97	(74)
North	0.9x	0.77	x	4	x	10.63	x	0.63	x	0.7	=	13	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.63	x	0.7	=	10.72	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.63	x	0.7	=	10.72	(74)
North	0.9x	0.77	x	1.3	x	10.63	x	0.63	x	0.7	=	4.22	(74)
North	0.9x	0.77	x	3.2	x	20.32	x	0.63	x	0.7	=	19.87	(74)
North	0.9x	0.77	x	1.9	x	20.32	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	4.3	x	20.32	x	0.63	x	0.7	=	26.7	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.63	x	0.7	=	24.84	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.63	x	0.7	=	20.49	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.63	x	0.7	=	20.49	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.63	x	0.7	=	8.07	(74)
North	0.9x	0.77	x	3.2	x	34.53	x	0.63	x	0.7	=	33.77	(74)
North	0.9x	0.77	x	1.9	x	34.53	x	0.63	x	0.7	=	20.05	(74)
North	0.9x	0.77	x	4.3	x	34.53	x	0.63	x	0.7	=	45.38	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.63	x	0.7	=	42.21	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.63	x	0.7	=	34.82	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.63	x	0.7	=	34.82	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.63	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	3.2	x	55.46	x	0.63	x	0.7	=	54.24	(74)
North	0.9x	0.77	x	1.9	x	55.46	x	0.63	x	0.7	=	32.21	(74)
North	0.9x	0.77	x	4.3	x	55.46	x	0.63	x	0.7	=	72.89	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.63	x	0.7	=	67.8	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.63	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	3.2	x	74.72	x	0.63	x	0.7	=	73.07	(74)
North	0.9x	0.77	x	1.9	x	74.72	x	0.63	x	0.7	=	43.38	(74)
North	0.9x	0.77	x	4.3	x	74.72	x	0.63	x	0.7	=	98.19	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.63	x	0.7	=	91.34	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.63	x	0.7	=	75.35	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.63	x	0.7	=	75.35	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.63	x	0.7	=	29.68	(74)
North	0.9x	0.77	x	3.2	x	79.99	x	0.63	x	0.7	=	78.22	(74)
North	0.9x	0.77	x	1.9	x	79.99	x	0.63	x	0.7	=	46.44	(74)
North	0.9x	0.77	x	4.3	x	79.99	x	0.63	x	0.7	=	105.11	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.63	x	0.7	=	97.78	(74)

North	0.9x	0.77	x	3.3	x	79.99	x	0.63	x	0.7	=	80.67	(74)
North	0.9x	0.77	x	3.3	x	79.99	x	0.63	x	0.7	=	80.67	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.63	x	0.7	=	31.78	(74)
North	0.9x	0.77	x	3.2	x	74.68	x	0.63	x	0.7	=	73.03	(74)
North	0.9x	0.77	x	1.9	x	74.68	x	0.63	x	0.7	=	43.36	(74)
North	0.9x	0.77	x	4.3	x	74.68	x	0.63	x	0.7	=	98.14	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.63	x	0.7	=	91.29	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.63	x	0.7	=	75.31	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.63	x	0.7	=	75.31	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.63	x	0.7	=	29.67	(74)
North	0.9x	0.77	x	3.2	x	59.25	x	0.63	x	0.7	=	57.94	(74)
North	0.9x	0.77	x	1.9	x	59.25	x	0.63	x	0.7	=	34.4	(74)
North	0.9x	0.77	x	4.3	x	59.25	x	0.63	x	0.7	=	77.86	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.63	x	0.7	=	72.43	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.63	x	0.7	=	59.75	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.63	x	0.7	=	59.75	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.63	x	0.7	=	23.54	(74)
North	0.9x	0.77	x	3.2	x	41.52	x	0.63	x	0.7	=	40.6	(74)
North	0.9x	0.77	x	1.9	x	41.52	x	0.63	x	0.7	=	24.11	(74)
North	0.9x	0.77	x	4.3	x	41.52	x	0.63	x	0.7	=	54.56	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.63	x	0.7	=	50.75	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.63	x	0.7	=	41.87	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.63	x	0.7	=	41.87	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.63	x	0.7	=	16.49	(74)
North	0.9x	0.77	x	3.2	x	24.19	x	0.63	x	0.7	=	23.66	(74)
North	0.9x	0.77	x	1.9	x	24.19	x	0.63	x	0.7	=	14.05	(74)
North	0.9x	0.77	x	4.3	x	24.19	x	0.63	x	0.7	=	31.79	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.63	x	0.7	=	29.57	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.63	x	0.7	=	24.4	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.63	x	0.7	=	24.4	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.63	x	0.7	=	9.61	(74)
North	0.9x	0.77	x	3.2	x	13.12	x	0.63	x	0.7	=	12.83	(74)
North	0.9x	0.77	x	1.9	x	13.12	x	0.63	x	0.7	=	7.62	(74)
North	0.9x	0.77	x	4.3	x	13.12	x	0.63	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.63	x	0.7	=	13.23	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.63	x	0.7	=	13.23	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.63	x	0.7	=	5.21	(74)
North	0.9x	0.77	x	3.2	x	8.86	x	0.63	x	0.7	=	8.67	(74)
North	0.9x	0.77	x	1.9	x	8.86	x	0.63	x	0.7	=	5.15	(74)
North	0.9x	0.77	x	4.3	x	8.86	x	0.63	x	0.7	=	11.65	(74)

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North	0.9x	0.77	x	4	x	8.86	x	0.63	x	0.7	=	10.84	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.63	x	0.7	=	3.52	(74)

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

(83)m=	69.22	132.28	224.78	361.05	486.37	520.67	486.11	385.67	270.25	157.46	85.39	57.7	(83)

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

(84)m=	577.22	638.04	713.81	822.84	920	927.51	875.75	781.84	680.59	595.28	554.84	551.34	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.94	0.81	0.64	0.73	0.94	0.99	1	1	(86)

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

(87)m=	19.67	19.78	20.01	20.36	20.69	20.91	20.98	20.96	20.77	20.37	19.97	19.65	(87)

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

(88)m=	19.98	19.98	19.98	19.99	19.99	20	20	20.01	20	19.99	19.99	19.99	(88)

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

(89)m=	1	1	1	0.98	0.91	0.72	0.51	0.6	0.9	0.99	1	1	(89)

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

(90)m=	18.18	18.35	18.69	19.2	19.67	19.94	20	19.99	19.79	19.22	18.63	18.17	(90)

fLA = Living area ÷ (4) = | 0.4 | (91)

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

(92)m=	18.78	18.93	19.22	19.66	20.08	20.33	20.39	20.38	20.19	19.68	19.17	18.76	(92)

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

(93)m=	18.78	18.93	19.22	19.66	20.08	20.33	20.39	20.38	20.19	19.68	19.17	18.76	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.91	0.75	0.57	0.65	0.91	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	576.5	636.56	709.52	803.96	839.67	697.69	496.11	508.14	616.75	588.1	553.49	550.8	(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=	2002	1934.45	1750.13	1463.58	1136.95	769.67	509.09	533.4	820.53	1231.98	1644.52	1993.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1060.58	872.18	774.21	474.93	221.18	0	0	0	0	479.05	785.54	1073.71	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 5741.36 | (98)

Space heating requirement in kWh/m²/year | 46.87 | (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1060.58	872.18	774.21	474.93	221.18	0	0	0	0	479.05	785.54	1073.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1134.31	932.81	828.03	507.94	236.55	0	0	0	0	512.35	840.15	1148.35		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													6140.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4		
Efficiency of water heater													79.8	(216)
(217)m=	88.51	88.4	88.1	87.33	85.47	79.8	79.8	79.8	79.8	87.26	88.16	88.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	241.41	212.92	224.05	202.18	202.09	192.91	184.79	203.43	203.28	209.82	220.16	235.29		
Total = Sum(219a)$_{1...12}$ =													2532.33	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6140.5	
Water heating fuel used			2532.33	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			454.09	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1326.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	546.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1873.33	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		2147.93	(272)

TER =	17.53	(273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: A08_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39	(1a) x	2.8	(2a) =	109.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		109.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.3		x1/[1/(1.3)+ 0.04]	=	1.61			(27)
Windows Type 2			2.5		x1/[1/(1.3)+ 0.04]	=	3.09			(27)
Windows Type 3			4.1		x1/[1/(1.3)+ 0.04]	=	5.07			(27)
Walls	31.92	12.9	19.02	x	0.15	=	2.85			(29)
Total area of elements, m²			31.92							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.6 (36)

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

Total fabric heat loss (33) + (36) = 19.97 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	10.09	9.98	9.86	9.29	9.17	8.6	8.6	8.48	8.83	9.17	9.4	9.63	(38)

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

(39)m=	30.06	29.94	29.83	29.25	29.14	28.56	28.56	28.45	28.79	29.14	29.37	29.6	

Average = Sum(39)$_{1…12}$ /12= 29.22 (39)

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

(40)m=	0.77	0.77	0.76	0.75	0.75	0.73	0.73	0.73	0.74	0.75	0.75	0.76

Average = Sum(40)$_{1…12}$ /12= 0.75 (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 1.38 (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 66.98 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	73.67	70.99	68.31	65.64	62.96	60.28	60.28	62.96	65.64	68.31	70.99	73.67

Total = Sum(44)$_{1…12}$ = 803.71 (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=	109.25	95.56	98.6	85.97	82.49	71.18	65.96	75.69	76.59	89.26	97.43	105.81

Total = Sum(45)$_{1…12}$ = 1053.78 (45)

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

(46)m=	16.39	14.33	14.79	12.89	12.37	10.68	9.89	11.35	11.49	13.39	14.62	15.87	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	164.53	145.48	153.88	139.46	137.76	124.67	121.23	130.96	130.09	144.54	150.93	161.08	(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=	164.53	145.48	153.88	139.46	137.76	124.67	121.23	130.96	130.09	144.54	150.93	161.08

Output from water heater (annual)$_{1...12}$ 1704.62 (64)

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

(65)m=	80.55	71.71	77.01	71.38	71.65	66.46	66.15	69.39	68.26	73.9	75.19	79.4	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69	69	69	69	69	69	69	69	69	69	69	69	(66)

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

(67)m=	10.62	9.44	7.67	5.81	4.34	3.67	3.96	5.15	6.91	8.78	10.24	10.92	(67)

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

(68)m=	119.03	120.26	117.15	110.52	102.16	94.3	89.05	87.81	90.92	97.55	105.91	113.78	(68)

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

(69)m=	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	(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=	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	(71)

Water heating gains (Table 5)

(72)m=	108.26	106.72	103.5	99.14	96.3	92.31	88.91	93.26	94.81	99.33	104.43	106.72	(72)

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

(73)m=	281.62	280.12	272.03	259.17	246.5	233.97	225.62	229.92	236.34	249.35	264.29	275.12	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.3	x	2.5	x	19.64	x	0.53	x	0.82	=	5.76	(76)
East	0.9x	0.3	x	4.1	x	19.64	x	0.53	x	0.7	=	8.07	(76)
East	0.9x	0.3	x	2.5	x	38.42	x	0.53	x	0.82	=	11.27	(76)
East	0.9x	0.3	x	4.1	x	38.42	x	0.53	x	0.7	=	15.78	(76)
East	0.9x	0.3	x	2.5	x	63.27	x	0.53	x	0.82	=	18.56	(76)

East	0.9x	0.3	x	4.1	x	63.27	x	0.53	x	0.7	=	25.99	(76)
East	0.9x	0.3	x	2.5	x	92.28	x	0.53	x	0.82	=	27.07	(76)
East	0.9x	0.3	x	4.1	x	92.28	x	0.53	x	0.7	=	37.9	(76)
East	0.9x	0.3	x	2.5	x	113.09	x	0.53	x	0.82	=	33.18	(76)
East	0.9x	0.3	x	4.1	x	113.09	x	0.53	x	0.7	=	46.45	(76)
East	0.9x	0.3	x	2.5	x	115.77	x	0.53	x	0.82	=	33.96	(76)
East	0.9x	0.3	x	4.1	x	115.77	x	0.53	x	0.7	=	47.55	(76)
East	0.9x	0.3	x	2.5	x	110.22	x	0.53	x	0.82	=	32.33	(76)
East	0.9x	0.3	x	4.1	x	110.22	x	0.53	x	0.7	=	45.27	(76)
East	0.9x	0.3	x	2.5	x	94.68	x	0.53	x	0.82	=	27.77	(76)
East	0.9x	0.3	x	4.1	x	94.68	x	0.53	x	0.7	=	38.88	(76)
East	0.9x	0.3	x	2.5	x	73.59	x	0.53	x	0.82	=	21.59	(76)
East	0.9x	0.3	x	4.1	x	73.59	x	0.53	x	0.7	=	30.22	(76)
East	0.9x	0.3	x	2.5	x	45.59	x	0.53	x	0.82	=	13.37	(76)
East	0.9x	0.3	x	4.1	x	45.59	x	0.53	x	0.7	=	18.72	(76)
East	0.9x	0.3	x	2.5	x	24.49	x	0.53	x	0.82	=	7.18	(76)
East	0.9x	0.3	x	4.1	x	24.49	x	0.53	x	0.7	=	10.06	(76)
East	0.9x	0.3	x	2.5	x	16.15	x	0.53	x	0.82	=	4.74	(76)
East	0.9x	0.3	x	4.1	x	16.15	x	0.53	x	0.7	=	6.63	(76)
West	0.9x	0.77	x	1.3	x	19.64	x	0.53	x	0.7	=	6.56	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.53	x	0.7	=	12.84	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.53	x	0.7	=	21.15	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.53	x	0.7	=	30.84	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.53	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	1.3	x	115.77	x	0.53	x	0.7	=	38.69	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.53	x	0.7	=	36.84	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.53	x	0.7	=	31.64	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.53	x	0.7	=	24.6	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.53	x	0.7	=	15.24	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.53	x	0.7	=	8.19	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.53	x	0.7	=	5.4	(80)

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

(83)m=	20.39	39.89	65.7	95.81	117.42	120.2	114.44	98.3	76.41	47.33	25.43	16.77	(83)

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

(84)m=	302.01	320.01	337.72	354.98	363.93	354.18	340.06	328.22	312.75	296.69	289.72	291.89	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.72	0.51	0.37	0.4	0.63	0.89	0.97	0.99	(86)

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

(87)m=	20.47	20.56	20.72	20.89	20.98	21	21	21	20.99	20.9	20.67	20.46	(87)

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

(88)m=	20.28	20.28	20.28	20.3	20.3	20.31	20.31	20.31	20.31	20.3	20.29	20.29	(88)

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

(89)m=	0.99	0.98	0.94	0.85	0.67	0.46	0.31	0.34	0.57	0.86	0.97	0.99	(89)

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

(90)m=	19.59	19.72	19.93	20.17	20.28	20.31	20.31	20.31	20.3	20.19	19.88	19.58	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	20.06	20.17	20.35	20.56	20.65	20.68	20.68	20.68	20.67	20.57	20.31	20.05	(92)

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

(93)m=	20.06	20.17	20.35	20.56	20.65	20.68	20.68	20.68	20.67	20.57	20.31	20.05	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.86	0.7	0.49	0.34	0.37	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	297.21	311.72	319.2	305.04	253.66	173.17	116.53	121.76	187.27	257.67	279.67	288.01	(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=	473.77	457.28	413.2	341.01	260.86	173.65	116.56	121.82	189.24	290.47	387.86	469.12	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	131.36	97.81	69.93	25.9	5.35	0	0	0	0	24.4	77.89	134.75	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 567.4 (98)

Space heating requirement in kWh/m²/year 14.55 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		567.4	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	595.77	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1704.62	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1789.86	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	23.86	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		101.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	101.58	(331)
Energy for lighting (calculated in Appendix L)		187.63	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	572.55	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	12.38	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	584.93	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				584.93	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	52.72	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	97.38	(379)
Total CO2, kg/year	sum of (376)…(382) =				735.03	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				18.85	(384)
EI rating (section 14)					88.27	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: A08_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39	(1a) x	2.8	(2a) =	109.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	109.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(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)	0.43	(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) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

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

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Windows Type 2			1.5	x1/[1/(1.4)+ 0.04]		=	1.99			(27)
Windows Type 3			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Walls	31.92	9.75	22.17	x	0.18	=	3.99			(29)
Total area of elements, m²			31.92							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.6 (36)

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

Total fabric heat loss (33) + (36) = 17.89 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.99	21.83	21.68	20.97	20.84	20.22	20.22	20.11	20.46	20.84	21.11	21.39	(38)

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

(39)m=	39.88	39.72	39.57	38.86	38.73	38.11	38.11	38	38.35	38.73	39	39.28	

Average = Sum(39)$_{1…12}$ /12= 38.86 (39)

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

(40)m=	1.02	1.02	1.01	1	0.99	0.98	0.98	0.97	0.98	0.99	1	1.01

Average = Sum(40)$_{1...12}$ /12= 1 (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 1.38 (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 66.98 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.67	70.99	68.31	65.64	62.96	60.28	60.28	62.96	65.64	68.31	70.99	73.67	
										Total = Sum(44)$_{1...12}$ =		803.71	(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=	109.25	95.56	98.6	85.97	82.49	71.18	65.96	75.69	76.59	89.26	97.43	105.81	
										Total = Sum(45)$_{1...12}$ =		1053.78	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	16.39	14.33	14.79	12.89	12.37	10.68	9.89	11.35	11.49	13.39	14.62	15.87	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4	(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=	155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4

Output from water heater (annual)$_{1...12}$ 1602.4 (64)

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

(65)m=	73.6	65.44	70.06	64.66	64.7	59.74	59.21	62.44	61.54	66.95	68.47	72.46	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69	69	69	69	69	69	69	69	69	69	69	69	(66)

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

(67)m=	11.15	9.9	8.05	6.1	4.56	3.85	4.16	5.4	7.25	9.21	10.75	11.46	(67)

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

(68)m=	119.03	120.26	117.15	110.52	102.16	94.3	89.05	87.81	90.92	97.55	105.91	113.78	(68)

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

(69)m=	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	(71)

Water heating gains (Table 5)

(72)m=	98.93	97.38	94.17	89.8	86.97	82.97	79.58	83.93	85.47	89.99	95.1	97.39	(72)

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

(73)m=	275.8	274.24	266.07	253.12	240.38	227.82	219.48	223.84	230.35	243.45	258.46	269.32	(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)	
East	0.9x	0.3	x	1.5	x	19.64	x	0.63	x	0.7	=	3.51	(76)
East	0.9x	0.3	x	2.47	x	19.64	x	0.63	x	0.7	=	5.78	(76)
East	0.9x	0.3	x	1.5	x	38.42	x	0.63	x	0.7	=	6.86	(76)
East	0.9x	0.3	x	2.47	x	38.42	x	0.63	x	0.7	=	11.3	(76)
East	0.9x	0.3	x	1.5	x	63.27	x	0.63	x	0.7	=	11.3	(76)

East	0.9x	0.3	x	2.47	x	63.27	x	0.63	x	0.7	=	18.61	(76)
East	0.9x	0.3	x	1.5	x	92.28	x	0.63	x	0.7	=	16.48	(76)
East	0.9x	0.3	x	2.47	x	92.28	x	0.63	x	0.7	=	27.14	(76)
East	0.9x	0.3	x	1.5	x	113.09	x	0.63	x	0.7	=	20.2	(76)
East	0.9x	0.3	x	2.47	x	113.09	x	0.63	x	0.7	=	33.26	(76)
East	0.9x	0.3	x	1.5	x	115.77	x	0.63	x	0.7	=	20.68	(76)
East	0.9x	0.3	x	2.47	x	115.77	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.3	x	1.5	x	110.22	x	0.63	x	0.7	=	19.69	(76)
East	0.9x	0.3	x	2.47	x	110.22	x	0.63	x	0.7	=	32.42	(76)
East	0.9x	0.3	x	1.5	x	94.68	x	0.63	x	0.7	=	16.91	(76)
East	0.9x	0.3	x	2.47	x	94.68	x	0.63	x	0.7	=	27.84	(76)
East	0.9x	0.3	x	1.5	x	73.59	x	0.63	x	0.7	=	13.14	(76)
East	0.9x	0.3	x	2.47	x	73.59	x	0.63	x	0.7	=	21.64	(76)
East	0.9x	0.3	x	1.5	x	45.59	x	0.63	x	0.7	=	8.14	(76)
East	0.9x	0.3	x	2.47	x	45.59	x	0.63	x	0.7	=	13.41	(76)
East	0.9x	0.3	x	1.5	x	24.49	x	0.63	x	0.7	=	4.37	(76)
East	0.9x	0.3	x	2.47	x	24.49	x	0.63	x	0.7	=	7.2	(76)
East	0.9x	0.3	x	1.5	x	16.15	x	0.63	x	0.7	=	2.88	(76)
East	0.9x	0.3	x	2.47	x	16.15	x	0.63	x	0.7	=	4.75	(76)
West	0.9x	0.77	x	0.78	x	19.64	x	0.63	x	0.7	=	4.68	(80)
West	0.9x	0.77	x	0.78	x	38.42	x	0.63	x	0.7	=	9.16	(80)
West	0.9x	0.77	x	0.78	x	63.27	x	0.63	x	0.7	=	15.08	(80)
West	0.9x	0.77	x	0.78	x	92.28	x	0.63	x	0.7	=	22	(80)
West	0.9x	0.77	x	0.78	x	113.09	x	0.63	x	0.7	=	26.96	(80)
West	0.9x	0.77	x	0.78	x	115.77	x	0.63	x	0.7	=	27.6	(80)
West	0.9x	0.77	x	0.78	x	110.22	x	0.63	x	0.7	=	26.27	(80)
West	0.9x	0.77	x	0.78	x	94.68	x	0.63	x	0.7	=	22.57	(80)
West	0.9x	0.77	x	0.78	x	73.59	x	0.63	x	0.7	=	17.54	(80)
West	0.9x	0.77	x	0.78	x	45.59	x	0.63	x	0.7	=	10.87	(80)
West	0.9x	0.77	x	0.78	x	24.49	x	0.63	x	0.7	=	5.84	(80)
West	0.9x	0.77	x	0.78	x	16.15	x	0.63	x	0.7	=	3.85	(80)

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

(83)m=	13.97	27.32	44.99	65.62	80.42	82.32	78.37	67.32	52.33	32.42	17.41	11.48	(83)

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

(84)m=	289.77	301.56	311.06	318.74	320.8	310.14	297.86	291.16	282.68	275.87	275.87	280.8	(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=	0.99	0.99	0.98	0.96	0.89	0.73	0.55	0.59	0.82	0.96	0.99	1	(86)

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

(87)m=	20.07	20.16	20.34	20.59	20.82	20.96	20.99	20.99	20.92	20.66	20.33	20.06	(87)

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

(88)m=	20.06	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)

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

(89)m=	0.99	0.99	0.98	0.95	0.86	0.65	0.45	0.48	0.75	0.94	0.98	0.99	(89)

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

(90)m=	18.83	18.97	19.23	19.6	19.91	20.07	20.1	20.1	20.03	19.7	19.23	18.83	(90)

fLA = Living area ÷ (4) = 0.54 (91)

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

(92)m=	19.5	19.61	19.82	20.13	20.39	20.55	20.58	20.58	20.51	20.21	19.82	19.49	(92)

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

(93)m=	19.5	19.61	19.82	20.13	20.39	20.55	20.58	20.58	20.51	20.21	19.82	19.49	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.69	0.5	0.54	0.79	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	287.19	297.79	304.07	302.13	279	215.21	150.06	156.49	222.04	260.72	271.28	278.67	(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=	605.93	584.2	527.28	436.59	336.74	226.7	151.62	158.73	245.74	372.29	496.14	600.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	237.15	192.47	166.07	96.82	42.96	0	0	0	0	83	161.9	239.45	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1219.81 (98)

Space heating requirement in kWh/m²/year 31.28 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	237.15	192.47	166.07	96.82	42.96	0	0	0	0	83	161.9	239.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	253.63	205.85	177.61	103.55	45.94	0	0	0	0	88.77	173.16	256.09	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1304.61 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4

Efficiency of water heater 79.8 (216)

(217)m=	85.93	85.71	85.17	84.02	82.23	79.8	79.8	79.8	79.8	83.55	85.15	86.01	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.37	160.59	170.48	155.98	156.98	145.7	141.04	153.24	152.49	162.61	167.37	177.18

Total = Sum(219a)$_{1...12}$ = 1925.03 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			1304.61	
Water heating fuel used			1925.03	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			196.84	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	281.8	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	415.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				697.6	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	102.16	(268)
Total CO2, kg/year			sum of (265)…(271) =		838.69	(272)

TER = 21.5 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B44_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.7	(1a) x	2.8	(2a) =	211.96	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.96	(5)

2. Ventilation rate:

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

DRAFT

			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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(21)

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

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

Wind Factor (22a)m = (22)m ÷ 4

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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.5	x	1.3	=	3.25			(26)
Windows Type 1			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	45.92	23.1	22.82	x	0.15	=	3.42			(29)
Walls Type2	20.16	0	20.16	x	0.14	=	2.85			(29)
Total area of elements, m²			66.08							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.3 (36)

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

Total fabric heat loss (33) + (36) = 38.29 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.59	19.37	19.14	18.03	17.81	16.69	16.69	16.47	17.14	17.81	18.25	18.7	(38)

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

(39)m=	57.88	57.65	57.43	56.32	56.09	54.98	54.98	54.76	55.42	56.09	56.54	56.98	

Average = Sum(39)$_{1…12}$ /12= 56.26 (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.76	0.76	0.76	0.74	0.74	0.73	0.73	0.72	0.73	0.74	0.75	0.75

Average = Sum(40)$_{1…12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.38 (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 90.64 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.7	96.07	92.45	88.82	85.2	81.57	81.57	85.2	88.82	92.45	96.07	99.7	
											Total = Sum(44)$_{1…12}$ =	1087.62	(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=	147.85	129.31	133.44	116.33	111.62	96.32	89.26	102.43	103.65	120.79	131.85	143.18	
											Total = Sum(45)$_{1…12}$ =	1426.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.18	19.4	20.02	17.45	16.74	14.45	13.39	15.36	15.55	18.12	19.78	21.48	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	203.13	179.24	188.71	169.83	166.9	149.82	144.53	157.7	157.14	176.07	185.35	198.46	(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=	203.13	179.24	188.71	169.83	166.9	149.82	144.53	157.7	157.14	176.07	185.35	198.46	

Output from water heater (annual)$_{1...12}$ 2076.88 (64)

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

(65)m=	93.38	82.94	88.59	81.48	81.34	74.82	73.9	78.28	77.26	84.38	86.64	91.83	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.74	16.65	13.54	10.25	7.66	6.47	6.99	9.08	12.19	15.48	18.07	19.26	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	210.22	212.4	206.9	195.2	180.43	166.54	157.27	155.09	160.58	172.29	187.06	200.94	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	(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=	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	(71)
Water heating gains (Table 5)													
(72)m=	125.51	123.42	119.07	113.16	109.32	103.92	99.33	105.21	107.3	113.42	120.33	123.43	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	413.12	411.11	398.16	377.25	356.06	335.58	322.23	328.03	338.72	359.83	384.1	402.28	(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)	
Northeast 0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast 0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast 0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast 0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast 0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)

Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)
Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)

East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)

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

(83)m=	84.42	165.6	274.5	404.15	499.34	513.11	487.69	416.1	320.41	196.91	105.33	69.39	(83)

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

(84)m=	497.54	576.71	672.66	781.41	855.4	848.68	809.92	744.13	659.13	556.74	489.43	471.67	(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=	1	0.99	0.95	0.81	0.6	0.41	0.3	0.34	0.58	0.9	0.99	1	(86)

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

(87)m=	20.37	20.52	20.74	20.94	20.99	21	21	21	21	20.89	20.59	20.35	(87)

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

(88)m=	20.28	20.29	20.29	20.3	20.3	20.32	20.32	20.32	20.31	20.3	20.3	20.29	(88)

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

(89)m=	0.99	0.98	0.94	0.78	0.56	0.37	0.25	0.29	0.52	0.87	0.98	1	(89)

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

(90)m=	19.44	19.66	19.97	20.23	20.3	20.32	20.32	20.32	20.31	20.19	19.78	19.42	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

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

(92)m=	19.79	19.98	20.26	20.5	20.56	20.57	20.57	20.58	20.57	20.45	20.09	19.77	(92)

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

(93)m=	19.79	19.98	20.26	20.5	20.56	20.57	20.57	20.58	20.57	20.45	20.09	19.77	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.94	0.79	0.58	0.39	0.27	0.31	0.54	0.88	0.98	0.99	(94)

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

(95)m=	494.04	565.7	628.94	615.08	492.84	328.27	218.5	228.64	356.58	487.36	480.3	469.25	(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=	896.65	869.66	790.28	653.17	496.96	328.45	218.51	228.67	358.49	552.52	734.24	887.15	(97)

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

(98)m=	299.54	204.26	120.04	27.42	3.06	0	0	0	0	48.48	182.83	310.92	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1196.56 (98)

Space heating requirement in kWh/m²/year 15.81 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1196.56

Space heat from Community boilers (98) x (304a) x (305) x (306) = 1256.39 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2076.88

If DHW from community scheme:

Water heat from Community boilers (64) x (303a) x (305) x (306) = 2180.73 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 34.37 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 197.18 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 197.18 (331)

Energy for lighting (calculated in Appendix L) 330.98 (332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	824.91	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	17.84	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	842.75	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			842.75	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	102.33	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	171.78	(379)
Total CO2, kg/year	sum of (376)…(382) =			1116.86	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			14.75	(384)
EI rating (section 14)				87.6	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B44_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.7	(1a) x	2.8	(2a) =	211.96	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.96	(5)

2. Ventilation rate:

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

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				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(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

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.5	x	1.2	=	3			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 3			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 4			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 5			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Walls Type1	45.92	18.9	27.02	x	0.18	=	4.86			(29)
Walls Type2	20.16	0	20.16	x	0.18	=	3.63			(29)
Total area of elements, m²			66.08							(31)

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

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

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	33.23	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		3.3	(36)

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

Total fabric heat loss	(33) + (36) =	36.54	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.27	41.03	40.79	39.66	39.45	38.47	38.47	38.29	38.85	39.45	39.88	40.32	(38)

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

(39)m=	77.81	77.57	77.33	76.2	75.99	75.01	75.01	74.83	75.39	75.99	76.42	76.86	

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 76.2 (39)

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

(40)m=	1.03	1.02	1.02	1.01	1	0.99	0.99	0.99	1	1	1.01	1.02

Average = Sum(40)$_{1…12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.38 (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 90.64 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	99.7	96.07	92.45	88.82	85.2	81.57	81.57	85.2	88.82	92.45	96.07	99.7

Total = Sum(44)$_{1…12}$ = 1087.62 (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=	147.85	129.31	133.44	116.33	111.62	96.32	89.26	102.43	103.65	120.79	131.85	143.18

Total = Sum(45)$_{1…12}$ = 1426.04 (45)

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

(46)m=	22.18	19.4	20.02	17.45	16.74	14.45	13.39	15.36	15.55	18.12	19.78	21.48	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78	(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=	194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78	

Output from water heater (annual)$_{1…12}$ 1974.66 (64)

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

(65)m=	86.44	76.66	81.64	74.75	74.39	68.1	66.95	71.33	70.54	77.44	79.91	84.88	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	(66)

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

(67)m=	18.75	16.66	13.55	10.25	7.67	6.47	6.99	9.09	12.2	15.49	18.08	19.27	(67)

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

(68)m=	210.22	212.4	206.9	195.2	180.43	166.54	157.27	155.09	160.58	172.29	187.06	200.94	(68)

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

(69)m=	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	(71)

Water heating gains (Table 5)

(72)m=	116.18	114.08	109.74	103.83	99.99	94.58	89.99	95.88	97.97	104.09	110.99	114.09	(72)

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

(73)m=	406.79	404.78	391.83	370.92	349.73	329.24	315.9	321.7	332.4	353.51	377.78	395.95	(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)	
Northeast	0.9x	0.3	x	1.91	x	11.28	x	0.63	x	0.7	=	2.57	(75)
Northeast	0.9x	0.3	x	2.07	x	11.28	x	0.63	x	0.7	=	2.78	(75)
Northeast	0.9x	0.3	x	1.91	x	22.97	x	0.63	x	0.7	=	5.22	(75)
Northeast	0.9x	0.3	x	2.07	x	22.97	x	0.63	x	0.7	=	5.66	(75)
Northeast	0.9x	0.3	x	1.91	x	41.38	x	0.63	x	0.7	=	9.41	(75)

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Northeast	0.9x	0.3	x	2.07	x	41.38	x	0.63	x	0.7	=	10.2	(75)
Northeast	0.9x	0.3	x	1.91	x	67.96	x	0.63	x	0.7	=	15.45	(75)
Northeast	0.9x	0.3	x	2.07	x	67.96	x	0.63	x	0.7	=	16.75	(75)
Northeast	0.9x	0.3	x	1.91	x	91.35	x	0.63	x	0.7	=	20.77	(75)
Northeast	0.9x	0.3	x	2.07	x	91.35	x	0.63	x	0.7	=	22.51	(75)
Northeast	0.9x	0.3	x	1.91	x	97.38	x	0.63	x	0.7	=	22.15	(75)
Northeast	0.9x	0.3	x	2.07	x	97.38	x	0.63	x	0.7	=	24	(75)
Northeast	0.9x	0.3	x	1.91	x	91.1	x	0.63	x	0.7	=	20.72	(75)
Northeast	0.9x	0.3	x	2.07	x	91.1	x	0.63	x	0.7	=	22.45	(75)
Northeast	0.9x	0.3	x	1.91	x	72.63	x	0.63	x	0.7	=	16.52	(75)
Northeast	0.9x	0.3	x	2.07	x	72.63	x	0.63	x	0.7	=	17.9	(75)
Northeast	0.9x	0.3	x	1.91	x	50.42	x	0.63	x	0.7	=	11.47	(75)
Northeast	0.9x	0.3	x	2.07	x	50.42	x	0.63	x	0.7	=	12.43	(75)
Northeast	0.9x	0.3	x	1.91	x	28.07	x	0.63	x	0.7	=	6.38	(75)
Northeast	0.9x	0.3	x	2.07	x	28.07	x	0.63	x	0.7	=	6.92	(75)
Northeast	0.9x	0.3	x	1.91	x	14.2	x	0.63	x	0.7	=	3.23	(75)
Northeast	0.9x	0.3	x	2.07	x	14.2	x	0.63	x	0.7	=	3.5	(75)
Northeast	0.9x	0.3	x	1.91	x	9.21	x	0.63	x	0.7	=	2.1	(75)
Northeast	0.9x	0.3	x	2.07	x	9.21	x	0.63	x	0.7	=	2.27	(75)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)

East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)
East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)

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

(83)m=	79.9	156.72	259.78	382.47	472.56	485.58	461.53	393.78	303.22	186.34	99.68	65.67	(83)

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

(84)m=	486.69	561.5	651.6	753.4	822.28	814.83	777.43	715.48	635.61	539.85	477.46	461.63	(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=	1	0.99	0.98	0.92	0.78	0.58	0.42	0.48	0.75	0.96	0.99	1	(86)

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

(87)m=	19.97	20.12	20.39	20.71	20.91	20.99	21	21	20.95	20.65	20.25	19.94	(87)

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

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07	(88)

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

(89)m=	1	0.99	0.97	0.9	0.72	0.5	0.34	0.39	0.68	0.94	0.99	1	(89)

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

(90)m=	18.68	18.91	19.29	19.75	20	20.08	20.09	20.09	20.05	19.68	19.11	18.66	(90)

fLA = Living area ÷ (4) = 0.38 (91)

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

(92)m=	19.17	19.37	19.7	20.11	20.35	20.42	20.43	20.43	20.39	20.05	19.54	19.14	(92)

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

(93)m=	19.17	19.37	19.7	20.11	20.35	20.42	20.43	20.43	20.39	20.05	19.54	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=	1	0.99	0.97	0.9	0.74	0.53	0.37	0.42	0.7	0.94	0.99	1	(94)

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

(95)m=	484.28	555.29	630.85	675.25	608.5	430.81	286.8	300.43	447.14	507.99	472.33	459.88	(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=	1156.72	1122.14	1020.98	854.13	656.96	436.8	287.44	301.72	473.89	718.03	950.55	1148.36	(97)

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

(98)m=	500.3	380.92	290.26	128.79	36.06	0	0	0	0	156.27	344.32	512.22

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2349.14 (98)

Space heating requirement in kWh/m²/year 31.03 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	500.3	380.92	290.26	128.79	36.06	0	0	0	0	156.27	344.32	512.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	535.08	407.41	310.44	137.74	38.57	0	0	0	0	167.13	368.26	547.83	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2512.45 (211)

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

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

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

Water heating

Output from water heater (calculated above)

194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78

Efficiency of water heater 79.8 (216)

(217)m=	87.23	86.88	86.08	84.22	81.59	79.8	79.8	79.8	79.8	84.63	86.56	87.33	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.92	197.27	209.14	191.67	193.92	177.21	170.24	186.74	186.39	197.78	204.42	217.3

Total = Sum(219a)$_{1...12}$ = 2355.02 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2512.45	
Water heating fuel used		2355.02	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		331.17	(232)

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

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	542.69	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	508.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1051.37	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.88	(268)
Total CO2, kg/year			sum of (265)…(271) =		1262.18	(272)

TER = 16.67 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: C85_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.4	(1a) x	2.8	(2a) =	205.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.52	(5)

2. Ventilation rate:

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

DRAFT

			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			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 76.5 | (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.9	x1/[1/(1.3)+ 0.04]		=	2.35			(27)
Windows Type 2			4.1	x1/[1/(1.3)+ 0.04]		=	5.07			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			5.1	x1/[1/(1.3)+ 0.04]		=	6.3			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls	83.16	26.5	56.66	x	0.15	=	8.5			(29)
Total area of elements, m²			83.16							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = | 40.82 | (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = | 0 | (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K | 4.16 | (36)

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

Total fabric heat loss (33) + (36) = | 44.98 | (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.99	18.78	18.56	17.48	17.26	16.18	16.18	15.97	16.62	17.26	17.7	18.13	(38)

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

(39)m=	63.97	63.76	63.54	62.46	62.24	61.16	61.16	60.95	61.59	62.24	62.67	63.11	

Average = Sum(39)$_{1…12}$ /12= | 62.4 | (39)

DER WorkSheet: New dwelling design stage

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

(40)m=	0.87	0.87	0.87	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (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 89.44 (43)

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

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

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

(44)m=	98.38	94.8	91.23	87.65	84.07	80.49	80.49	84.07	87.65	91.23	94.8	98.38

Total = Sum(44)$_{1…12}$ = 1073.24 (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=	145.9	127.6	131.67	114.8	110.15	95.05	88.08	101.07	102.28	119.2	130.11	141.29

Total = Sum(45)$_{1…12}$ = 1407.19 (45)

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

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	201.17	177.53	186.95	168.29	165.43	148.54	143.35	156.35	155.77	174.47	183.6	196.57	(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=	201.17	177.53	186.95	168.29	165.43	148.54	143.35	156.35	155.77	174.47	183.6	196.57	

Output from water heater (annual)$_{1...12}$ | 2058.03 | (64)

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

(65)m=	92.73	82.37	88	80.96	80.85	74.4	73.51	77.83	76.8	83.85	86.06	91.2	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	(66)

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

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

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

(68)m=	205.1	207.23	201.86	190.45	176.03	162.49	153.44	151.31	156.67	168.09	182.5	196.05	(68)

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

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(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=	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	(71)

Water heating gains (Table 5)

(72)m=	124.64	122.57	118.28	112.45	108.66	103.33	98.8	104.61	106.67	112.71	119.52	122.58	(72)

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

(73)m=	405.91	403.93	391.24	370.78	350.06	330.02	316.94	322.67	333.13	353.79	377.54	395.31	(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)	
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	30.01	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	30.01	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	58.7	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	58.7	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	96.68	(76)

East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	96.68	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	141	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	141	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	172.8	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	172.8	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	176.89	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	176.89	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	168.41	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	168.41	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	144.66	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	144.66	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	112.44	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	112.44	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	69.66	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	69.66	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	37.42	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	37.42	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	24.68	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	24.68	(76)
South	0.9x	0.77	x	1.9	x	46.75	x	0.53	x	0.7	=	22.84	(78)
South	0.9x	0.77	x	1.9	x	76.57	x	0.53	x	0.7	=	37.4	(78)
South	0.9x	0.77	x	1.9	x	97.53	x	0.53	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	1.9	x	110.23	x	0.53	x	0.7	=	53.85	(78)
South	0.9x	0.77	x	1.9	x	114.87	x	0.53	x	0.7	=	56.11	(78)
South	0.9x	0.77	x	1.9	x	110.55	x	0.53	x	0.7	=	54	(78)
South	0.9x	0.77	x	1.9	x	108.01	x	0.53	x	0.7	=	52.76	(78)
South	0.9x	0.77	x	1.9	x	104.89	x	0.53	x	0.7	=	51.24	(78)
South	0.9x	0.77	x	1.9	x	101.89	x	0.53	x	0.7	=	49.77	(78)
South	0.9x	0.77	x	1.9	x	82.59	x	0.53	x	0.7	=	40.34	(78)
South	0.9x	0.77	x	1.9	x	55.42	x	0.53	x	0.7	=	27.07	(78)
South	0.9x	0.77	x	1.9	x	40.4	x	0.53	x	0.7	=	19.73	(78)
West	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.8	=	23.66	(80)
West	0.9x	0.77	x	5.1	x	19.64	x	0.53	x	0.8	=	29.43	(80)
West	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.8	=	46.29	(80)
West	0.9x	0.77	x	5.1	x	38.42	x	0.53	x	0.8	=	57.57	(80)
West	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.8	=	76.23	(80)
West	0.9x	0.77	x	5.1	x	63.27	x	0.53	x	0.8	=	94.82	(80)
West	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.8	=	111.17	(80)
West	0.9x	0.77	x	5.1	x	92.28	x	0.53	x	0.8	=	138.29	(80)
West	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.8	=	136.24	(80)
West	0.9x	0.77	x	5.1	x	113.09	x	0.53	x	0.8	=	169.47	(80)

West	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.8	=	139.47	(80)
West	0.9x	0.77	x	5.1	x	115.77	x	0.53	x	0.8	=	173.49	(80)
West	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.8	=	132.78	(80)
West	0.9x	0.77	x	5.1	x	110.22	x	0.53	x	0.8	=	165.17	(80)
West	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.8	=	114.06	(80)
West	0.9x	0.77	x	5.1	x	94.68	x	0.53	x	0.8	=	141.88	(80)
West	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.8	=	88.65	(80)
West	0.9x	0.77	x	5.1	x	73.59	x	0.53	x	0.8	=	110.28	(80)
West	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.8	=	54.92	(80)
West	0.9x	0.77	x	5.1	x	45.59	x	0.53	x	0.8	=	68.32	(80)
West	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.8	=	29.5	(80)
West	0.9x	0.77	x	5.1	x	24.49	x	0.53	x	0.8	=	36.7	(80)
West	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.8	=	19.46	(80)
West	0.9x	0.77	x	5.1	x	16.15	x	0.53	x	0.8	=	24.2	(80)

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

(83)m=	135.95	258.67	412.04	585.3	707.43	720.74	687.52	596.49	473.58	302.9	168.11	112.75	(83)

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

(84)m=	541.86	662.6	803.28	956.08	1057.49	1050.75	1004.47	919.15	806.7	656.68	545.65	508.06	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.92	0.75	0.54	0.37	0.27	0.3	0.52	0.86	0.98	1	(86)

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

(87)m=	20.29	20.49	20.75	20.94	20.99	21	21	21	21	20.89	20.55	20.25	(87)

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

(88)m=	20.19	20.19	20.2	20.21	20.21	20.22	20.22	20.23	20.22	20.21	20.21	20.2	(88)

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

(89)m=	0.99	0.97	0.9	0.71	0.5	0.33	0.22	0.25	0.47	0.82	0.97	0.99	(89)

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

(90)m=	19.24	19.54	19.9	20.15	20.21	20.22	20.22	20.23	20.22	20.1	19.63	19.2	(90)

fLA = Living area ÷ (4) = | 0.37 | (91)

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

(92)m=	19.63	19.89	20.21	20.44	20.5	20.51	20.51	20.51	20.5	20.39	19.97	19.59	(92)

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

(93)m=	19.63	19.89	20.21	20.44	20.5	20.51	20.51	20.51	20.5	20.39	19.97	19.59	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.9	0.72	0.51	0.34	0.24	0.27	0.49	0.83	0.97	0.99	(94)

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Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	536.04	641.12	720.02	688.13	543.66	361.21	239.11	250.53	392.49	545.93	530.46	504.16	(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=	980.54	955.56	871.24	720.92	547.44	361.43	239.13	250.57	394.4	609.2	806.54	971.11	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	330.7	211.31	112.51	23.61	2.81	0	0	0	0	47.08	198.78	347.41	

Total per year (kWh/year) = Sum(98)$_{1\ldots5,9\ldots12}$ = 1274.21 (98)

Space heating requirement in kWh/m²/year 17.36 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1274.21	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1337.92	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2058.03	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2160.93	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	34.99	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		191.18	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	191.18	(331)
Energy for lighting (calculated in Appendix L)		322.91	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

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CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	839.72	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	18.16	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	857.88	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			857.88	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	99.23	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	167.59	(379)
Total CO2, kg/year	sum of (376)…(382) =			1124.7	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.32	(384)
EI rating (section 14)				87.27	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: C85_Be Lean

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.4	(1a) x	2.8	(2a) =	205.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.52	(5)

2. Ventilation rate:

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

DRAFT

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

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

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *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*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			1.18	x1/[1/(1.4)+ 0.04]		=	1.56			(27)
Windows Type 2			2.55	x1/[1/(1.4)+ 0.04]		=	3.38			(27)
Windows Type 3			1.61	x1/[1/(1.4)+ 0.04]		=	2.13			(27)
Windows Type 4			3.17	x1/[1/(1.4)+ 0.04]		=	4.2			(27)
Windows Type 5			1.61	x1/[1/(1.4)+ 0.04]		=	2.13			(27)
Walls	83.16	18.34	64.82	x	0.18	=	11.67			(29)
Total area of elements, m²			83.16							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.16 (36)

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

Total fabric heat loss (33) + (36) = 39.51 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.16	39.91	39.68	38.56	38.35	37.38	37.38	37.2	37.75	38.35	38.77	39.21	(38)

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

(39)m=	79.67	79.43	79.19	78.07	77.86	76.89	76.89	76.71	77.27	77.86	78.29	78.73	

Average = Sum(39)$_{1…12}$ /12= 78.07 (39)

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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=	1.09	1.08	1.08	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.07	1.07

Average = Sum(40)$_{1…12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (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 89.44 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	98.38	94.8	91.23	87.65	84.07	80.49	80.49	84.07	87.65	91.23	94.8	98.38

Total = Sum(44)$_{1…12}$ = 1073.24 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(45)m=	145.9	127.6	131.67	114.8	110.15	95.05	88.08	101.07	102.28	119.2	130.11	141.29

Total = Sum(45)$_{1…12}$ = 1407.19 (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=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89	(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=	192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89

Output from water heater (annual)$_{1...12}$ 1955.81 (64)

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

(65)m=	85.79	76.1	81.06	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.34	84.26	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	(66)

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

(67)m=	18.32	16.27	13.23	10.02	7.49	6.32	6.83	8.88	11.92	15.13	17.66	18.83	(67)

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

(68)m=	205.1	207.23	201.86	190.45	176.03	162.49	153.44	151.31	156.67	168.09	182.5	196.05	(68)

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

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	(71)

Water heating gains (Table 5)

(72)m=	115.3	113.24	108.95	103.12	99.33	94	89.46	95.27	97.33	103.37	110.19	113.25	(72)

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

(73)m=	399.61	397.62	384.93	364.46	343.74	323.69	310.62	316.35	326.81	347.48	371.24	389.01	(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)	
East	0.9x	0.77	x	1.61	x	19.64	x	0.63	x	0.7	=	19.33	(76)
East	0.9x	0.77	x	1.61	x	19.64	x	0.63	x	0.7	=	19.33	(76)
East	0.9x	0.77	x	1.61	x	38.42	x	0.63	x	0.7	=	37.81	(76)
East	0.9x	0.77	x	1.61	x	38.42	x	0.63	x	0.7	=	37.81	(76)
East	0.9x	0.77	x	1.61	x	63.27	x	0.63	x	0.7	=	62.27	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	1.61	x	63.27	x	0.63	x	0.7	=	62.27	(76)
East	0.9x	0.77	x	1.61	x	92.28	x	0.63	x	0.7	=	90.81	(76)
East	0.9x	0.77	x	1.61	x	92.28	x	0.63	x	0.7	=	90.81	(76)
East	0.9x	0.77	x	1.61	x	113.09	x	0.63	x	0.7	=	111.29	(76)
East	0.9x	0.77	x	1.61	x	113.09	x	0.63	x	0.7	=	111.29	(76)
East	0.9x	0.77	x	1.61	x	115.77	x	0.63	x	0.7	=	113.93	(76)
East	0.9x	0.77	x	1.61	x	115.77	x	0.63	x	0.7	=	113.93	(76)
East	0.9x	0.77	x	1.61	x	110.22	x	0.63	x	0.7	=	108.46	(76)
East	0.9x	0.77	x	1.61	x	110.22	x	0.63	x	0.7	=	108.46	(76)
East	0.9x	0.77	x	1.61	x	94.68	x	0.63	x	0.7	=	93.17	(76)
East	0.9x	0.77	x	1.61	x	94.68	x	0.63	x	0.7	=	93.17	(76)
East	0.9x	0.77	x	1.61	x	73.59	x	0.63	x	0.7	=	72.42	(76)
East	0.9x	0.77	x	1.61	x	73.59	x	0.63	x	0.7	=	72.42	(76)
East	0.9x	0.77	x	1.61	x	45.59	x	0.63	x	0.7	=	44.86	(76)
East	0.9x	0.77	x	1.61	x	45.59	x	0.63	x	0.7	=	44.86	(76)
East	0.9x	0.77	x	1.61	x	24.49	x	0.63	x	0.7	=	24.1	(76)
East	0.9x	0.77	x	1.61	x	24.49	x	0.63	x	0.7	=	24.1	(76)
East	0.9x	0.77	x	1.61	x	16.15	x	0.63	x	0.7	=	15.89	(76)
East	0.9x	0.77	x	1.61	x	16.15	x	0.63	x	0.7	=	15.89	(76)
South	0.9x	0.77	x	1.18	x	46.75	x	0.63	x	0.7	=	16.86	(78)
South	0.9x	0.77	x	1.18	x	76.57	x	0.63	x	0.7	=	27.61	(78)
South	0.9x	0.77	x	1.18	x	97.53	x	0.63	x	0.7	=	35.17	(78)
South	0.9x	0.77	x	1.18	x	110.23	x	0.63	x	0.7	=	39.75	(78)
South	0.9x	0.77	x	1.18	x	114.87	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	1.18	x	110.55	x	0.63	x	0.7	=	39.87	(78)
South	0.9x	0.77	x	1.18	x	108.01	x	0.63	x	0.7	=	38.95	(78)
South	0.9x	0.77	x	1.18	x	104.89	x	0.63	x	0.7	=	37.83	(78)
South	0.9x	0.77	x	1.18	x	101.89	x	0.63	x	0.7	=	36.74	(78)
South	0.9x	0.77	x	1.18	x	82.59	x	0.63	x	0.7	=	29.78	(78)
South	0.9x	0.77	x	1.18	x	55.42	x	0.63	x	0.7	=	19.98	(78)
South	0.9x	0.77	x	1.18	x	40.4	x	0.63	x	0.7	=	14.57	(78)
West	0.9x	0.77	x	2.55	x	19.64	x	0.63	x	0.7	=	15.31	(80)
West	0.9x	0.77	x	3.17	x	19.64	x	0.63	x	0.7	=	19.03	(80)
West	0.9x	0.77	x	2.55	x	38.42	x	0.63	x	0.7	=	29.94	(80)
West	0.9x	0.77	x	3.17	x	38.42	x	0.63	x	0.7	=	37.22	(80)
West	0.9x	0.77	x	2.55	x	63.27	x	0.63	x	0.7	=	49.31	(80)
West	0.9x	0.77	x	3.17	x	63.27	x	0.63	x	0.7	=	61.3	(80)
West	0.9x	0.77	x	2.55	x	92.28	x	0.63	x	0.7	=	71.92	(80)
West	0.9x	0.77	x	3.17	x	92.28	x	0.63	x	0.7	=	89.4	(80)
West	0.9x	0.77	x	2.55	x	113.09	x	0.63	x	0.7	=	88.13	(80)
West	0.9x	0.77	x	3.17	x	113.09	x	0.63	x	0.7	=	109.56	(80)

West	0.9x	0.77	x	2.55	x	115.77	x	0.63	x	0.7	=	90.22	(80)
West	0.9x	0.77	x	3.17	x	115.77	x	0.63	x	0.7	=	112.16	(80)
West	0.9x	0.77	x	2.55	x	110.22	x	0.63	x	0.7	=	85.89	(80)
West	0.9x	0.77	x	3.17	x	110.22	x	0.63	x	0.7	=	106.78	(80)
West	0.9x	0.77	x	2.55	x	94.68	x	0.63	x	0.7	=	73.78	(80)
West	0.9x	0.77	x	3.17	x	94.68	x	0.63	x	0.7	=	91.72	(80)
West	0.9x	0.77	x	2.55	x	73.59	x	0.63	x	0.7	=	57.35	(80)
West	0.9x	0.77	x	3.17	x	73.59	x	0.63	x	0.7	=	71.29	(80)
West	0.9x	0.77	x	2.55	x	45.59	x	0.63	x	0.7	=	35.53	(80)
West	0.9x	0.77	x	3.17	x	45.59	x	0.63	x	0.7	=	44.17	(80)
West	0.9x	0.77	x	2.55	x	24.49	x	0.63	x	0.7	=	19.08	(80)
West	0.9x	0.77	x	3.17	x	24.49	x	0.63	x	0.7	=	23.72	(80)
West	0.9x	0.77	x	2.55	x	16.15	x	0.63	x	0.7	=	12.59	(80)
West	0.9x	0.77	x	3.17	x	16.15	x	0.63	x	0.7	=	15.65	(80)

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

(83)m=	89.85	170.39	270.31	382.69	461.71	470.1	448.55	389.67	310.22	199.2	110.99	74.59	(83)

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

(84)m=	489.45	568.01	655.24	747.15	805.44	793.79	759.17	706.01	637.03	546.68	482.23	463.6	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.44	0.49	0.76	0.96	0.99	1	(86)

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

(87)m=	19.91	20.07	20.34	20.67	20.89	20.98	21	20.99	20.94	20.63	20.21	19.88	(87)

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

(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.05	20.04	20.03	20.03	20.02	(88)

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

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.39	0.68	0.94	0.99	1	(89)

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

(90)m=	18.56	18.8	19.19	19.65	19.93	20.03	20.04	20.04	19.99	19.61	19.01	18.53	(90)

fLA = Living area ÷ (4) = 0.37 (91)

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

(92)m=	19.06	19.27	19.61	20.03	20.28	20.38	20.39	20.39	20.34	19.98	19.45	19.03	(92)

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

(93)m=	19.06	19.27	19.61	20.03	20.28	20.38	20.39	20.39	20.34	19.98	19.45	19.03	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.38	0.43	0.71	0.94	0.99	1	(94)

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

(95)m=	486.61	560.75	632.86	671.45	608.24	435.85	290.7	304.48	450.78	512.21	476.27	461.53	(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=	1175.76	1141.44	1038.55	868.76	668.44	444.5	291.71	306.35	482.09	730.72	966.92	1167.55	(97)

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

(98)m=	512.73	390.23	301.83	142.06	44.79	0	0	0	0	162.57	353.27	525.28

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2432.76 (98)

Space heating requirement in kWh/m²/year 33.14 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	512.73	390.23	301.83	142.06	44.79	0	0	0	0	162.57	353.27	525.28	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	548.37	417.35	322.82	151.94	47.9	0	0	0	0	173.87	377.83	561.8	(211)

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2601.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89

Efficiency of water heater 79.8 (216)

(217)m=	87.3	86.97	86.21	84.5	81.95	79.8	79.8	79.8	79.8	84.76	86.65	87.41	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.48	195.12	206.79	189.21	191.26	175.62	168.76	185.04	184.67	195.6	202.2	214.94

Total = Sum(219a)$_{1...12}$ = 2329.7 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2601.88	
Water heating fuel used		2329.7	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45	(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =	75	(231)
Electricity for lighting		323.47	(232)

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

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	562.01	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.03	(272)

TER = 17.33 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: A25_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.8	(2a) =	140	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.3	x1/[1/(1.3)+ 0.04]		=	1.61			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			1.9	x1/[1/(1.3)+ 0.04]		=	2.35			(27)
Windows Type 4			4.1	x1/[1/(1.3)+ 0.04]		=	5.07			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls	67.76	17.5	50.26	x	0.15	=	7.54			(29)
Total area of elements, m²			67.76							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.38 (36)

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

Total fabric heat loss (33) + (36) = 32.12 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.94	12.79	12.64	11.91	11.76	11.02	11.02	10.88	11.32	11.76	12.06	12.35	(38)

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

(39)m=	45.06	44.91	44.77	44.03	43.88	43.15	43.15	43	43.44	43.88	44.18	44.47	

Average = Sum(39)$_{1…12}$ /12= 43.99 (39)

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

(40)m=	0.9	0.9	0.9	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1…12}$ /12= 0.88 (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 1.69 (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 74.34 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77

Total = Sum(44)$_{1…12}$ = 892.08 (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=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44

Total = Sum(45)$_{1…12}$ = 1169.66 (45)

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

(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72	(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=	176.55	155.99	164.72	148.91	146.83	132.5	128.49	139.29	138.51	154.35	161.64	172.72	

Output from water heater (annual)$_{1...12}$ 1820.5 (64)

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

(65)m=	84.54	75.21	80.61	74.52	74.66	69.06	68.56	72.15	71.06	77.16	78.75	83.27	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.13	11.66	9.48	7.18	5.37	4.53	4.89	6.36	8.54	10.84	12.66	13.49	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)
Water heating gains (Table 5)													
(72)m=	113.63	111.92	108.35	103.5	100.35	95.92	92.16	96.98	98.7	103.71	109.38	111.92	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	322.34	320.69	311.09	295.75	280.44	265.45	255.55	260.32	268.06	283.58	301.4	314.5	(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)	
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	13.13	(76)
East	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.8	=	23.66	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	25.68	(76)
East	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.8	=	46.29	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	42.3	(76)

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East	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.8	=	76.23	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	61.69	(76)
East	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.8	=	111.17	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	75.6	(76)
East	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.8	=	136.24	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	77.39	(76)
East	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.8	=	139.47	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	73.68	(76)
East	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.8	=	132.78	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	63.29	(76)
East	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.8	=	114.06	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	49.19	(76)
East	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.8	=	88.65	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	30.47	(76)
East	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.8	=	54.92	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	16.37	(76)
East	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.8	=	29.5	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.8	=	19.46	(76)
South	0.9x	0.77	x	1.3	x	46.75	x	0.53	x	0.7	=	15.63	(78)
South	0.9x	0.77	x	1.3	x	76.57	x	0.53	x	0.7	=	25.59	(78)
South	0.9x	0.77	x	1.3	x	97.53	x	0.53	x	0.7	=	32.6	(78)
South	0.9x	0.77	x	1.3	x	110.23	x	0.53	x	0.7	=	36.84	(78)
South	0.9x	0.77	x	1.3	x	114.87	x	0.53	x	0.7	=	38.39	(78)
South	0.9x	0.77	x	1.3	x	110.55	x	0.53	x	0.7	=	36.95	(78)
South	0.9x	0.77	x	1.3	x	108.01	x	0.53	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	1.3	x	104.89	x	0.53	x	0.7	=	35.06	(78)
South	0.9x	0.77	x	1.3	x	101.89	x	0.53	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	1.3	x	82.59	x	0.53	x	0.7	=	27.6	(78)
South	0.9x	0.77	x	1.3	x	55.42	x	0.53	x	0.7	=	18.52	(78)
South	0.9x	0.77	x	1.3	x	40.4	x	0.53	x	0.7	=	13.5	(78)
West	0.9x	0.77	x	1.9	x	19.64	x	0.53	x	0.8	=	10.96	(80)
West	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	15	(80)
West	0.9x	0.77	x	1.9	x	38.42	x	0.53	x	0.8	=	21.45	(80)
West	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	29.35	(80)
West	0.9x	0.77	x	1.9	x	63.27	x	0.53	x	0.8	=	35.32	(80)
West	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	48.34	(80)
West	0.9x	0.77	x	1.9	x	92.28	x	0.53	x	0.8	=	51.52	(80)
West	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	70.5	(80)
West	0.9x	0.77	x	1.9	x	113.09	x	0.53	x	0.8	=	63.14	(80)
West	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	86.4	(80)

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West	0.9x	0.77	x	1.9	x	115.77	x	0.53	x	0.8	=	64.63	(80)
West	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	88.44	(80)
West	0.9x	0.77	x	1.9	x	110.22	x	0.53	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	84.2	(80)
West	0.9x	0.77	x	1.9	x	94.68	x	0.53	x	0.8	=	52.86	(80)
West	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	72.33	(80)
West	0.9x	0.77	x	1.9	x	73.59	x	0.53	x	0.8	=	41.08	(80)
West	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.9	x	45.59	x	0.53	x	0.8	=	25.45	(80)
West	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	34.83	(80)
West	0.9x	0.77	x	1.9	x	24.49	x	0.53	x	0.8	=	13.67	(80)
West	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	18.71	(80)
West	0.9x	0.77	x	1.9	x	16.15	x	0.53	x	0.8	=	9.02	(80)
West	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	12.34	(80)

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

(83)m=	78.39	148.36	234.78	331.72	399.77	406.88	388.3	337.59	269.2	173.28	96.78	65.11	(83)

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

(84)m=	400.73	469.05	545.88	627.46	680.21	672.33	643.85	597.91	537.26	456.86	398.18	379.62	(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=	0.99	0.97	0.92	0.78	0.59	0.41	0.29	0.33	0.55	0.86	0.98	0.99	(86)

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

(87)m=	20.3	20.48	20.71	20.92	20.99	21	21	21	20.99	20.88	20.55	20.27	(87)

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

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

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

(89)m=	0.99	0.97	0.9	0.74	0.54	0.36	0.24	0.27	0.49	0.82	0.97	0.99	(89)

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

(90)m=	19.25	19.5	19.83	20.1	20.18	20.2	20.2	20.2	20.19	20.06	19.62	19.21	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

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

(92)m=	19.68	19.91	20.2	20.44	20.51	20.53	20.53	20.53	20.52	20.4	20.01	19.65	(92)

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

(93)m=	19.68	19.91	20.2	20.44	20.51	20.53	20.53	20.53	20.52	20.4	20.01	19.65	(93)

8. Space heating requirement

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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.96	0.91	0.76	0.56	0.38	0.26	0.3	0.52	0.84	0.97	0.99	(94)

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

(95)m=	394.76	452.49	494.19	475.15	381.81	255.57	169.63	177.68	276.92	381.51	384.39	375.28	(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=	693.23	673.96	613.2	508.08	386.72	255.91	169.66	177.74	279.06	430	570.37	687.12	(97)

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

(98)m=	222.06	148.83	88.54	23.71	3.65	0	0	0	0	36.08	133.91	232.01	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 888.78 (98)

Space heating requirement in kWh/m²/year 17.78 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		888.78	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	933.22	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1820.5	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1911.52	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	28.45	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		130.23	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	130.23	(331)
Energy for lighting (calculated in Appendix L)		231.81	(332)

12b. CO2 Emissions – Community heating scheme

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CO2 from other sources of space and water heating (not CHP)

Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x	0.22	=	682.74	(367)
Electrical energy for heat distribution	[(313) x	0.52	=	14.76	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	697.5	(373)
CO2 associated with space heating (secondary)	(309) x	0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x	0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			697.5	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	67.59	(378)
CO2 associated with electricity for lighting	(332))) x	0.52	=	120.31	(379)
Total CO2, kg/year	sum of (376)…(382) =			885.4	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			17.71	(384)
EI rating (section 14)				87.51	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: A25_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.8	(2a) =	140	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(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) =	20	÷ (5) =	0.14 (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)	0.39	(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) =	0.33	(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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Windows Type 2			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Windows Type 3			1.14	x1/[1/(1.4)+ 0.04]		=	1.51			(27)
Windows Type 4			2.46	x1/[1/(1.4)+ 0.04]		=	3.26			(27)
Windows Type 5			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Walls	67.76	12.5	55.26	x	0.18	=	9.95			(29)
Total area of elements, m²			67.76							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.89 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.38 (36)

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

Total fabric heat loss (33) + (36) = 29.27 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	27.12	26.97	26.22	26.08	25.42	25.42	25.3	25.68	26.08	26.36	26.66	(38)

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

(39)m=	56.56	56.4	56.24	55.49	55.35	54.7	54.7	54.58	54.95	55.35	55.64	55.93	

Average = Sum(39)$_{1…12}$ /12= 55.49 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12	

Average = Sum(40)$_{1…12}$ /12= 1.11 (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 1.69 (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 74.34 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	

Total = Sum(44)$_{1…12}$ = 892.08 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	

Total = Sum(45)$_{1…12}$ = 1169.66 (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=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	(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=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	

Output from water heater (annual)$_{1...12}$ 1718.27 (64)

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

(65)m=	77.6	68.93	73.67	67.8	67.72	62.34	61.62	65.21	64.34	70.22	72.03	76.33	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)

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

(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.76	13.61	(67)

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

(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)

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

(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)

Water heating gains (Table 5)

(72)m=	104.3	102.58	99.01	94.17	91.02	86.59	82.82	87.65	89.36	94.38	100.05	102.59	(72)

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

(73)m=	316.12	314.45	304.84	289.47	274.15	259.15	249.26	254.04	261.8	277.33	295.17	308.28	(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)	
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36	(76)
East	0.9x	0.77	x	2.46	x	19.64	x	0.63	x	0.7	=	14.77	(76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32	(76)
East	0.9x	0.77	x	2.46	x	38.42	x	0.63	x	0.7	=	28.88	(76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(76)

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East	0.9x	0.77	x	2.46	x	63.27	x	0.63	x	0.7	=	47.57	(76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(76)
East	0.9x	0.77	x	2.46	x	92.28	x	0.63	x	0.7	=	69.38	(76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(76)
East	0.9x	0.77	x	2.46	x	113.09	x	0.63	x	0.7	=	85.02	(76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(76)
East	0.9x	0.77	x	2.46	x	115.77	x	0.63	x	0.7	=	87.04	(76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(76)
East	0.9x	0.77	x	2.46	x	110.22	x	0.63	x	0.7	=	82.86	(76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	2.46	x	94.68	x	0.63	x	0.7	=	71.18	(76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(76)
East	0.9x	0.77	x	2.46	x	73.59	x	0.63	x	0.7	=	55.32	(76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(76)
East	0.9x	0.77	x	2.46	x	45.59	x	0.63	x	0.7	=	34.27	(76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(76)
East	0.9x	0.77	x	2.46	x	24.49	x	0.63	x	0.7	=	18.41	(76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(76)
East	0.9x	0.77	x	2.46	x	16.15	x	0.63	x	0.7	=	12.14	(76)
South	0.9x	0.77	x	0.78	x	46.75	x	0.63	x	0.7	=	11.14	(78)
South	0.9x	0.77	x	0.78	x	76.57	x	0.63	x	0.7	=	18.25	(78)
South	0.9x	0.77	x	0.78	x	97.53	x	0.63	x	0.7	=	23.25	(78)
South	0.9x	0.77	x	0.78	x	110.23	x	0.63	x	0.7	=	26.28	(78)
South	0.9x	0.77	x	0.78	x	114.87	x	0.63	x	0.7	=	27.38	(78)
South	0.9x	0.77	x	0.78	x	110.55	x	0.63	x	0.7	=	26.35	(78)
South	0.9x	0.77	x	0.78	x	108.01	x	0.63	x	0.7	=	25.75	(78)
South	0.9x	0.77	x	0.78	x	104.89	x	0.63	x	0.7	=	25	(78)
South	0.9x	0.77	x	0.78	x	101.89	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	0.78	x	82.59	x	0.63	x	0.7	=	19.69	(78)
South	0.9x	0.77	x	0.78	x	55.42	x	0.63	x	0.7	=	13.21	(78)
South	0.9x	0.77	x	0.78	x	40.4	x	0.63	x	0.7	=	9.63	(78)
West	0.9x	0.77	x	1.14	x	19.64	x	0.63	x	0.7	=	6.84	(80)
West	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36	(80)
West	0.9x	0.77	x	1.14	x	38.42	x	0.63	x	0.7	=	13.39	(80)
West	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32	(80)
West	0.9x	0.77	x	1.14	x	63.27	x	0.63	x	0.7	=	22.04	(80)
West	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(80)
West	0.9x	0.77	x	1.14	x	92.28	x	0.63	x	0.7	=	32.15	(80)
West	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(80)
West	0.9x	0.77	x	1.14	x	113.09	x	0.63	x	0.7	=	39.4	(80)
West	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(80)

West	0.9x	0.77	x	1.14	x	115.77	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(80)
West	0.9x	0.77	x	1.14	x	110.22	x	0.63	x	0.7	=	38.4	(80)
West	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(80)
West	0.9x	0.77	x	1.14	x	94.68	x	0.63	x	0.7	=	32.98	(80)
West	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(80)
West	0.9x	0.77	x	1.14	x	73.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(80)
West	0.9x	0.77	x	1.14	x	45.59	x	0.63	x	0.7	=	15.88	(80)
West	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(80)
West	0.9x	0.77	x	1.14	x	24.49	x	0.63	x	0.7	=	8.53	(80)
West	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(80)
West	0.9x	0.77	x	1.14	x	16.15	x	0.63	x	0.7	=	5.63	(80)
West	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(80)

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

(83)m=	51.48	97.16	153.2	215.79	259.64	264.11	252.11	219.44	175.42	113.31	63.5	42.8	(83)

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

(84)m=	367.6	411.61	458.03	505.27	533.79	523.26	501.36	473.48	437.22	390.65	358.68	351.08	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.93	0.82	0.64	0.47	0.52	0.77	0.95	0.99	1	(86)

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

(87)m=	19.91	20.06	20.31	20.62	20.86	20.97	20.99	20.99	20.92	20.61	20.21	19.89	(87)

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

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

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

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.69	0.93	0.99	0.99	(89)

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

(90)m=	18.54	18.75	19.11	19.56	19.86	19.99	20	20	19.94	19.56	18.98	18.51	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

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

(92)m=	19.11	19.29	19.61	20	20.27	20.4	20.42	20.42	20.35	20	19.49	19.08	(92)

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

(93)m=	19.11	19.29	19.61	20	20.27	20.4	20.42	20.42	20.35	20	19.49	19.08	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.96	0.91	0.79	0.59	0.41	0.46	0.72	0.93	0.98	0.99	(94)

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

(95)m=	364.47	405.17	441.96	459.07	419.2	307.55	207.49	217.05	316.53	364.09	352.67	348.67	(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=	837.52	811.83	737.19	615.97	474.64	317.06	208.74	219.15	343.49	520.32	689.5	832.35	(97)

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

(98)m=	351.95	273.27	219.65	112.97	41.25	0	0	0	0	116.24	242.52	359.86	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1717.71 (98)

Space heating requirement in kWh/m²/year 34.35 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	351.95	273.27	219.65	112.97	41.25	0	0	0	0	116.24	242.52	359.86	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	376.42	292.27	234.92	120.82	44.11	0	0	0	0	124.32	259.38	384.88	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 1837.12 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

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

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

Water heating

Output from water heater (calculated above)

167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04

Efficiency of water heater 79.8 (216)

(217)m=	86.74	86.43	85.73	84.24	82.03	79.8	79.8	79.8	79.8	84.22	86.03	86.85	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	193.52	171.42	182.02	166.8	168.42	155.51	150.13	163.67	163.04	172.97	178.12	188.87

Total = $Sum(219a)_{1...12}$ = 2054.47 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1837.12	
Water heating fuel used		2054.47	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

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boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			233.78	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	396.82	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	443.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			840.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	121.33	(268)
Total CO2, kg/year		sum of (265)…(271) =		1000.84	(272)

TER = 20.02 (273)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B57_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.1	(1a) x	2.8	(2a) =	196.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	196.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.3	=	3.12			(26)
Windows Type 1			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 2			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	22.96	23	-0.04	x	0.15	=	-0.01			(29)
Walls Type2	8.12	0	8.12	x	0.14	=	1.15			(29)
Walls Type3	12.04	0	12.04	x	0.13	=	1.59			(29)
Total area of elements, m²			43.12							(31)

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

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

Total fabric heat loss (33) + (36) = 33.47 (37)

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

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

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(38)m=	18.14	17.93	17.73	16.7	16.49	15.46	15.46	15.25	15.87	16.49	16.9	17.31	(38)

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

(39)m=	51.61	51.4	51.19	50.16	49.95	48.92	48.92	48.72	49.33	49.95	50.37	50.78	

Average = $Sum(39)_{1…12}$ /12= 50.11 (39)

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

(40)m=	0.74	0.73	0.73	0.72	0.71	0.7	0.7	0.69	0.7	0.71	0.72	0.72	

Average = $Sum(40)_{1…12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (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 87.6 (43)

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

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

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

(44)m=	96.36	92.86	89.36	85.85	82.35	78.84	78.84	82.35	85.85	89.36	92.86	96.36	

Total = $Sum(44)_{1…12}$ = 1051.24 (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=	142.9	124.98	128.97	112.44	107.89	93.1	86.27	99	100.18	116.75	127.44	138.39	

Total = $Sum(45)_{1…12}$ = 1378.34 (45)

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

(46)m=	21.44	18.75	19.35	16.87	16.18	13.97	12.94	14.85	15.03	17.51	19.12	20.76	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(57)

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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	198.18	174.91	184.25	165.94	163.17	146.6	141.55	154.28	153.67	172.03	180.94	193.67	(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=	198.18	174.91	184.25	165.94	163.17	146.6	141.55	154.28	153.67	172.03	180.94	193.67

Output from water heater (annual)$_{1...12}$ | 2029.18 | (64)

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

(65)m=	91.74	81.5	87.11	80.18	80.1	73.75	72.91	77.14	76.11	83.04	85.17	90.24	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	(66)

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

(67)m=	17.61	15.64	12.72	9.63	7.2	6.08	6.57	8.54	11.46	14.55	16.98	18.1	(67)

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

(68)m=	197.53	199.58	194.41	183.42	169.54	156.49	147.78	145.73	150.89	161.89	175.77	188.81	(68)

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

(69)m=	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	(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=	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	(71)

Water heating gains (Table 5)

(72)m=	123.3	121.28	117.08	111.36	107.65	102.43	97.99	103.68	105.7	111.61	118.29	121.29	(72)

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

(73)m=	395.17	393.23	380.94	361.14	341.12	321.73	309.06	314.67	324.78	344.78	367.77	384.93	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)
North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)

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North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
Northeast	0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast	0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast	0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast	0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast	0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)
Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)

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Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)

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

(83)m=	48.3	93.01	159.22	256.49	345.42	369.58	345.14	274	191.77	111.08	59.72	40.17	(83)

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

(84)m=	443.47	486.23	540.16	617.63	686.54	691.31	654.21	588.67	516.55	455.85	427.49	425.1	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.87	0.66	0.45	0.33	0.38	0.65	0.93	0.99	1	(86)

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

(87)m=	20.39	20.5	20.68	20.9	20.99	21	21	21	20.99	20.86	20.6	20.38	(87)

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

(88)m=	20.31	20.31	20.31	20.33	20.33	20.34	20.34	20.35	20.34	20.33	20.32	20.32	(88)

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

(89)m=	1	0.99	0.96	0.85	0.62	0.41	0.28	0.33	0.59	0.91	0.99	1	(89)

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

(90)m=	19.49	19.65	19.92	20.22	20.32	20.34	20.34	20.35	20.33	20.18	19.8	19.48	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	19.9	20.03	20.26	20.53	20.62	20.64	20.64	20.64	20.63	20.48	20.16	19.88	(92)

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

(93)m=	19.9	20.03	20.26	20.53	20.62	20.64	20.64	20.64	20.63	20.48	20.16	19.88	(93)

8. Space heating requirement

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

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

Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.86	0.64	0.43	0.3	0.35	0.62	0.91	0.99	1	(94)

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

(95)m=	440.87	480.24	520.03	528.16	439.29	295.11	197.53	206.48	318.66	416.83	421.27	423.17	(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=	804.86	777.77	704.52	583.19	445.57	295.37	197.55	206.52	322.1	493.77	657.82	796.35	(97)

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

(98)m=	270.81	199.94	137.26	39.63	4.67	0	0	0	0	57.24	170.31	277.64

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1157.5 (98)

Space heating requirement in kWh/m²/year 16.51 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1157.5	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1215.38	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2029.18	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2130.64	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.46	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		182.59	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	182.59	(331)

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Energy for lighting (calculated in Appendix L)			311	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	= 803.04	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 17.37	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 820.41	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			820.41	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 94.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 161.41	(379)
Total CO2, kg/year	sum of (376)…(382) =			1076.58	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			15.36	(384)
EI rating (section 14)				87.47	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B57_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.1	(1a) x	2.8	(2a) =	196.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.1	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		196.28	(5)

2. Ventilation rate:

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

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

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

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

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

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

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

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

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

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.2	=	2.88			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 3			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 4			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 5			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Walls Type1	22.96	17.53	5.43	x	0.18	=	0.98			(29)
Walls Type2	8.12	0	8.12	x	0.18	=	1.46			(29)
Walls Type3	12.04	0	12.04	x	0.18	=	2.17			(29)
Total area of elements, m²			43.12							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

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

Total fabric heat loss (33) + (36) = 29.7 (37)

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

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

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(38)m=	38.56	38.32	38.08	36.98	36.77	35.81	35.81	35.64	36.18	36.77	37.19	37.63	(38)

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

(39)m=	68.26	68.02	67.78	66.68	66.47	65.51	65.51	65.34	65.88	66.47	66.89	67.33	

Average = Sum(39)$_{1…12}$ /12= 66.68 (39)

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

(40)m=	0.97	0.97	0.97	0.95	0.95	0.93	0.93	0.93	0.94	0.95	0.95	0.96	

Average = Sum(40)$_{1…12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (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 87.6 (43)

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

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

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

(44)m=	96.36	92.86	89.36	85.85	82.35	78.84	78.84	82.35	85.85	89.36	92.86	96.36	

Total = Sum(44)$_{1…12}$ = 1051.24 (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=	142.9	124.98	128.97	112.44	107.89	93.1	86.27	99	100.18	116.75	127.44	138.39	

Total = Sum(45)$_{1…12}$ = 1378.34 (45)

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

(46)m=	21.44	18.75	19.35	16.87	16.18	13.97	12.94	14.85	15.03	17.51	19.12	20.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99	(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=	189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99

Output from water heater (annual)$_{1...12}$ | 1926.95 | (64)

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

(65)m=	84.79	75.23	80.16	73.46	73.15	67.03	65.96	70.19	69.38	76.1	78.45	83.29	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	(66)

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

(67)m=	17.62	15.65	12.73	9.64	7.2	6.08	6.57	8.54	11.46	14.55	16.99	18.11	(67)

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

(68)m=	197.53	199.58	194.41	183.42	169.54	156.49	147.78	145.73	150.89	161.89	175.77	188.81	(68)

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

(69)m=	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	(71)

Water heating gains (Table 5)

(72)m=	113.97	111.94	107.74	102.03	98.32	93.1	88.66	94.35	96.37	102.28	108.96	111.95	(72)

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

(73)m=	388.85	386.9	374.61	354.81	334.79	315.4	302.73	308.34	318.45	338.45	361.44	378.6	(73)

6. Solar gains:

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

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)

North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
Northeast	0.9x	0.3	x	1.76	x	11.28	x	0.63	x	0.7	=	2.36	(75)
Northeast	0.9x	0.3	x	1.91	x	11.28	x	0.63	x	0.7	=	2.57	(75)
Northeast	0.9x	0.3	x	1.76	x	22.97	x	0.63	x	0.7	=	4.81	(75)
Northeast	0.9x	0.3	x	1.91	x	22.97	x	0.63	x	0.7	=	5.22	(75)
Northeast	0.9x	0.3	x	1.76	x	41.38	x	0.63	x	0.7	=	8.67	(75)
Northeast	0.9x	0.3	x	1.91	x	41.38	x	0.63	x	0.7	=	9.41	(75)
Northeast	0.9x	0.3	x	1.76	x	67.96	x	0.63	x	0.7	=	14.24	(75)

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Northeast	0.9x	0.3	x	1.91	x	67.96	x	0.63	x	0.7	=	15.45	(75)
Northeast	0.9x	0.3	x	1.76	x	91.35	x	0.63	x	0.7	=	19.14	(75)
Northeast	0.9x	0.3	x	1.91	x	91.35	x	0.63	x	0.7	=	20.77	(75)
Northeast	0.9x	0.3	x	1.76	x	97.38	x	0.63	x	0.7	=	20.41	(75)
Northeast	0.9x	0.3	x	1.91	x	97.38	x	0.63	x	0.7	=	22.15	(75)
Northeast	0.9x	0.3	x	1.76	x	91.1	x	0.63	x	0.7	=	19.09	(75)
Northeast	0.9x	0.3	x	1.91	x	91.1	x	0.63	x	0.7	=	20.72	(75)
Northeast	0.9x	0.3	x	1.76	x	72.63	x	0.63	x	0.7	=	15.22	(75)
Northeast	0.9x	0.3	x	1.91	x	72.63	x	0.63	x	0.7	=	16.52	(75)
Northeast	0.9x	0.3	x	1.76	x	50.42	x	0.63	x	0.7	=	10.57	(75)
Northeast	0.9x	0.3	x	1.91	x	50.42	x	0.63	x	0.7	=	11.47	(75)
Northeast	0.9x	0.3	x	1.76	x	28.07	x	0.63	x	0.7	=	5.88	(75)
Northeast	0.9x	0.3	x	1.91	x	28.07	x	0.63	x	0.7	=	6.38	(75)
Northeast	0.9x	0.3	x	1.76	x	14.2	x	0.63	x	0.7	=	2.98	(75)
Northeast	0.9x	0.3	x	1.91	x	14.2	x	0.63	x	0.7	=	3.23	(75)
Northeast	0.9x	0.3	x	1.76	x	9.21	x	0.63	x	0.7	=	1.93	(75)
Northeast	0.9x	0.3	x	1.91	x	9.21	x	0.63	x	0.7	=	2.1	(75)

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

(83)m=	42.17	81.21	139.02	223.95	301.6	322.69	301.35	239.24	167.44	96.98	52.15	35.07	(83)

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

(84)m=	431.02	468.11	513.63	578.76	636.38	638.09	604.08	547.58	485.89	435.43	413.59	413.68	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.84	0.64	0.47	0.54	0.83	0.97	1	1	(86)

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

(87)m=	20.02	20.13	20.34	20.65	20.89	20.98	21	20.99	20.93	20.63	20.28	20	(87)

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

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

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

(89)m=	1	0.99	0.98	0.94	0.8	0.56	0.38	0.44	0.76	0.96	0.99	1	(89)

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

(90)m=	18.79	18.95	19.26	19.71	20.02	20.13	20.14	20.14	20.07	19.69	19.19	18.78	(90)

fLA = Living area ÷ (4) = 0.45 (91)

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

(92)m=	19.34	19.48	19.75	20.13	20.41	20.51	20.52	20.52	20.46	20.11	19.68	19.33	(92)

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

(93)m=	19.34	19.48	19.75	20.13	20.41	20.51	20.52	20.52	20.46	20.11	19.68	19.33	(93)

8. Space heating requirement

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

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

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.81	0.59	0.42	0.49	0.79	0.96	0.99	1	(94)

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

(95)m=	429.32	464.84	504.77	543.8	516.25	379.24	256.14	267.38	381.5	419.07	410.26	412.38	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1026.69	991.85	898.06	748.8	578.78	387.28	257.06	269.38	418.8	632.31	841.31	1018.56	(97)

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

(98)m=	444.44	354.15	292.61	147.6	46.52	0	0	0	0	158.65	310.35	451

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2205.32 (98)

Space heating requirement in kWh/m²/year 31.46 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	444.44	354.15	292.61	147.6	46.52	0	0	0	0	158.65	310.35	451	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	475.34	378.76	312.95	157.86	49.76	0	0	0	0	169.68	331.93	482.35	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2358.63 (211)

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

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

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

Water heating

Output from water heater (calculated above)

	189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99	

Efficiency of water heater 79.8 (216)

(217)m=	87.01	86.77	86.17	84.64	82.05	79.8	79.8	79.8	79.8	84.74	86.36	87.1	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.78	192.54	203.75	186.12	188.29	173.17	166.5	182.45	182.05	192.77	199.78	212.38

Total = Sum(219a)$_{1...12}$ = 2297.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2358.63
Water heating fuel used		2297.59
Electricity for pumps, fans and electric keep-hot		

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central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			311.17	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	509.46	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	496.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1005.74	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	161.5	(268)
Total CO2, kg/year		sum of (265)…(271) =		1206.17	(272)

TER = 17.21 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**

Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: C114_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.2	(1a) x	2.8	(2a) =	109.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.2	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	109.76	(5)

2. Ventilation rate:

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

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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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			4.1	x1/[1/(1.3)+ 0.04]		=	5.07			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			1.3	x1/[1/(1.3)+ 0.04]		=	1.61			(27)
Walls	29.12	13	16.12	x	0.15	=	2.42			(29)
Roof	39.2	0	39.2	x	0.1	=	3.92			(30)
Total area of elements, m²			68.32							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.42 (36)

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

Total fabric heat loss (33) + (36) = 25.39 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	10.14	10.03	9.91	9.34	9.22	8.64	8.64	8.53	8.87	9.22	9.45	9.68	(38)

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

(39)m=	35.53	35.42	35.3	34.73	34.61	34.03	34.03	33.92	34.26	34.61	34.84	35.07	

Average = Sum(39)$_{1…12}$ /12= 34.7 (39)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.87	0.87	0.88	0.89	0.89	

Average = Sum(40)$_{1...12}$ /12= 0.89 (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 1.39 (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 67.1 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.81	71.13	68.44	65.76	63.07	60.39	60.39	63.07	65.76	68.44	71.13	73.81	

Total = Sum(44)$_{1...12}$ = 805.19 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(45)m=	109.46	95.73	98.79	86.12	82.64	71.31	66.08	75.83	76.73	89.43	97.61	106	

Total = Sum(45)$_{1...12}$ = 1055.74 (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=	16.42	14.36	14.82	12.92	12.4	10.7	9.91	11.37	11.51	13.41	14.64	15.9	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(59)m=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	164.73	145.66	154.06	139.62	137.92	124.8	121.36	131.1	130.23	144.7	151.11	161.28	(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=	164.73	145.66	154.06	139.62	137.92	124.8	121.36	131.1	130.23	144.7	151.11	161.28	

Output from water heater (annual) $_{1...12}$ 1706.58 (64)

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

(65)m=	80.62	71.77	77.07	71.43	71.7	66.51	66.19	69.43	68.31	73.96	75.25	79.47	(65)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	10.66	9.47	7.7	5.83	4.36	3.68	3.97	5.17	6.93	8.8	10.28	10.95	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	119.53	120.77	117.64	110.99	102.59	94.69	89.42	88.18	91.31	97.96	106.36	114.25	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(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=	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	(71)
Water heating gains (Table 5)													
(72)m=	108.35	106.8	103.59	99.21	96.37	92.37	88.97	93.33	94.87	99.4	104.52	106.81	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	282.32	280.82	272.7	259.8	247.09	234.52	226.14	230.45	236.89	249.94	264.93	275.8	(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)	
East	0.9x	0.3	x	1.3	x	19.64	x	0.53	x	0.8	=	2.92	(76)
East	0.9x	0.3	x	1.3	x	38.42	x	0.53	x	0.8	=	5.72	(76)
East	0.9x	0.3	x	1.3	x	63.27	x	0.53	x	0.8	=	9.42	(76)
East	0.9x	0.3	x	1.3	x	92.28	x	0.53	x	0.8	=	13.73	(76)
East	0.9x	0.3	x	1.3	x	113.09	x	0.53	x	0.8	=	16.83	(76)

East	0.9x	0.3	x	1.3	x	115.77	x	0.53	x	0.8	=	17.23	(76)
East	0.9x	0.3	x	1.3	x	110.22	x	0.53	x	0.8	=	16.4	(76)
East	0.9x	0.3	x	1.3	x	94.68	x	0.53	x	0.8	=	14.09	(76)
East	0.9x	0.3	x	1.3	x	73.59	x	0.53	x	0.8	=	10.95	(76)
East	0.9x	0.3	x	1.3	x	45.59	x	0.53	x	0.8	=	6.78	(76)
East	0.9x	0.3	x	1.3	x	24.49	x	0.53	x	0.8	=	3.64	(76)
East	0.9x	0.3	x	1.3	x	16.15	x	0.53	x	0.8	=	2.4	(76)
West	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.7	=	20.7	(80)
West	0.9x	0.3	x	2.6	x	19.64	x	0.53	x	0.8	=	5.85	(80)
West	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.7	=	40.5	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.53	x	0.8	=	11.44	(80)
West	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.7	=	66.7	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.53	x	0.8	=	18.83	(80)
West	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.7	=	97.27	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.53	x	0.8	=	27.47	(80)
West	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.7	=	119.21	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.53	x	0.8	=	33.66	(80)
West	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.7	=	122.04	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.53	x	0.8	=	34.46	(80)
West	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.7	=	116.18	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.53	x	0.8	=	32.81	(80)
West	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.7	=	99.8	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.53	x	0.8	=	28.18	(80)
West	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.7	=	77.57	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.53	x	0.8	=	21.9	(80)
West	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.7	=	48.06	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.53	x	0.8	=	13.57	(80)
West	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.7	=	25.81	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.53	x	0.8	=	7.29	(80)
West	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.7	=	17.03	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.53	x	0.8	=	4.81	(80)

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

(83)m=	29.47	57.65	94.95	138.47	169.71	173.72	165.39	142.07	110.43	68.41	36.75	24.24	(83)

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

(84)m=	311.79	338.47	367.65	398.28	416.8	408.24	391.53	372.52	347.32	318.35	301.68	300.03	(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=	0.99	0.98	0.96	0.88	0.73	0.53	0.38	0.42	0.66	0.91	0.98	0.99	(86)

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

(87)m=	20.29	20.4	20.6	20.83	20.96	21	21	21	20.98	20.82	20.52	20.27	(87)

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

(88)m=	20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.2	20.19	20.18	20.18	20.17	(88)

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

(89)m=	0.99	0.98	0.95	0.85	0.68	0.46	0.31	0.35	0.59	0.88	0.97	0.99	(89)

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

(90)m=	19.22	19.39	19.67	19.99	20.14	20.19	20.19	20.2	20.18	19.99	19.58	19.2	(90)

fLA = Living area ÷ (4) = 0.69 (91)

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

(92)m=	19.96	20.1	20.32	20.57	20.71	20.75	20.75	20.75	20.74	20.57	20.24	19.94	(92)

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

(93)m=	19.96	20.1	20.32	20.57	20.71	20.75	20.75	20.75	20.74	20.57	20.24	19.94	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.87	0.71	0.51	0.36	0.4	0.64	0.89	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	307.74	330.85	349.25	346.12	297.15	207.78	141.2	147.41	221.65	284.62	293.54	296.82	(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=	556.5	538.19	487.78	405.3	311.75	209.28	141.34	147.66	227.36	344.99	457.66	552.1	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	185.08	139.33	103.06	42.62	10.86	0	0	0	0	44.91	118.16	189.93	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 833.95 (98)

Space heating requirement in kWh/m²/year 21.27 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		833.95	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	875.65	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1706.58	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1791.9	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	26.68	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		114.36	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	114.36	(331)
Energy for lighting (calculated in Appendix L)		188.22	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	640.21	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	13.84	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	654.06	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				654.06	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	59.35	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	97.68	(379)
Total CO2, kg/year	sum of (376)…(382) =				811.09	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				20.69	(384)
EI rating (section 14)					87.09	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: C114_Be Lean

Address :	The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.2	(1a) x	2.8	(2a) =	109.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.2	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	109.76	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(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) =	20	÷ (5) =	0.18	(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 *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*		0	(11)
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)	0.43	(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) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

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

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

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

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

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			2.46	x1/[1/(1.4)+ 0.04]		=	3.26			(27)
Windows Type 2			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Windows Type 3			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Walls	29.12	9.8	19.32	x	0.18	=	3.48			(29)
Roof	39.2	0	39.2	x	0.13	=	5.1			(30)
Total area of elements, m²			68.32							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.94 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.42 (36)

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

Total fabric heat loss (33) + (36) = 24.35 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.08	21.93	21.78	21.07	20.94	20.32	20.32	20.2	20.55	20.94	21.2	21.49	(38)

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

(39)m=	46.44	46.28	46.13	45.42	45.29	44.67	44.67	44.56	44.91	45.29	45.56	45.84	

Average = Sum(39)$_{1…12}$ /12= 45.42 (39)

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

(40)m=	1.18	1.18	1.18	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17

Average = Sum(40)1…12 /12= 1.16 (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 1.39 (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 67.1 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.81	71.13	68.44	65.76	63.07	60.39	60.39	63.07	65.76	68.44	71.13	73.81	
										Total = Sum(44)1…12 =		805.19	(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=	109.46	95.73	98.79	86.12	82.64	71.31	66.08	75.83	76.73	89.43	97.61	106	
										Total = Sum(45)1…12 =		1055.74	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	16.42	14.36	14.82	12.92	12.4	10.7	9.91	11.37	11.51	13.41	14.64	15.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6	(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=	156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6	

Output from water heater (annual)$_{1...12}$ 1604.35 (64)

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

(65)m=	73.67	65.5	70.12	64.71	64.75	59.78	59.25	62.49	61.59	67.01	68.53	72.52	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	(66)

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

(67)m=	11.31	10.05	8.17	6.19	4.62	3.9	4.22	5.48	7.36	9.34	10.91	11.63	(67)

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

(68)m=	119.53	120.77	117.64	110.99	102.59	94.69	89.42	88.18	91.31	97.96	106.36	114.25	(68)

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

(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	(71)

Water heating gains (Table 5)

(72)m=	99.02	97.47	94.25	89.87	87.03	83.03	79.63	83.99	85.54	90.07	95.18	97.48	(72)

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

(73)m=	276.64	275.06	266.84	253.83	241.02	228.41	220.05	224.43	230.98	244.15	259.22	270.13	(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)	
East	0.9x	0.3	x	0.78	x	19.64	x	0.63	x	0.7	=	1.82	(76)
East	0.9x	0.3	x	0.78	x	38.42	x	0.63	x	0.7	=	3.57	(76)
East	0.9x	0.3	x	0.78	x	63.27	x	0.63	x	0.7	=	5.88	(76)
East	0.9x	0.3	x	0.78	x	92.28	x	0.63	x	0.7	=	8.57	(76)
East	0.9x	0.3	x	0.78	x	113.09	x	0.63	x	0.7	=	10.5	(76)

East	0.9x	0.3	x	0.78	x	115.77	x	0.63	x	0.7	=	10.75	(76)
East	0.9x	0.3	x	0.78	x	110.22	x	0.63	x	0.7	=	10.24	(76)
East	0.9x	0.3	x	0.78	x	94.68	x	0.63	x	0.7	=	8.79	(76)
East	0.9x	0.3	x	0.78	x	73.59	x	0.63	x	0.7	=	6.83	(76)
East	0.9x	0.3	x	0.78	x	45.59	x	0.63	x	0.7	=	4.23	(76)
East	0.9x	0.3	x	0.78	x	24.49	x	0.63	x	0.7	=	2.27	(76)
East	0.9x	0.3	x	0.78	x	16.15	x	0.63	x	0.7	=	1.5	(76)
West	0.9x	0.77	x	2.46	x	19.64	x	0.63	x	0.7	=	14.77	(80)
West	0.9x	0.3	x	1.56	x	19.64	x	0.63	x	0.7	=	3.65	(80)
West	0.9x	0.77	x	2.46	x	38.42	x	0.63	x	0.7	=	28.88	(80)
West	0.9x	0.3	x	1.56	x	38.42	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	2.46	x	63.27	x	0.63	x	0.7	=	47.57	(80)
West	0.9x	0.3	x	1.56	x	63.27	x	0.63	x	0.7	=	11.75	(80)
West	0.9x	0.77	x	2.46	x	92.28	x	0.63	x	0.7	=	69.38	(80)
West	0.9x	0.3	x	1.56	x	92.28	x	0.63	x	0.7	=	17.14	(80)
West	0.9x	0.77	x	2.46	x	113.09	x	0.63	x	0.7	=	85.02	(80)
West	0.9x	0.3	x	1.56	x	113.09	x	0.63	x	0.7	=	21.01	(80)
West	0.9x	0.77	x	2.46	x	115.77	x	0.63	x	0.7	=	87.04	(80)
West	0.9x	0.3	x	1.56	x	115.77	x	0.63	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	2.46	x	110.22	x	0.63	x	0.7	=	82.86	(80)
West	0.9x	0.3	x	1.56	x	110.22	x	0.63	x	0.7	=	20.47	(80)
West	0.9x	0.77	x	2.46	x	94.68	x	0.63	x	0.7	=	71.18	(80)
West	0.9x	0.3	x	1.56	x	94.68	x	0.63	x	0.7	=	17.59	(80)
West	0.9x	0.77	x	2.46	x	73.59	x	0.63	x	0.7	=	55.32	(80)
West	0.9x	0.3	x	1.56	x	73.59	x	0.63	x	0.7	=	13.67	(80)
West	0.9x	0.77	x	2.46	x	45.59	x	0.63	x	0.7	=	34.27	(80)
West	0.9x	0.3	x	1.56	x	45.59	x	0.63	x	0.7	=	8.47	(80)
West	0.9x	0.77	x	2.46	x	24.49	x	0.63	x	0.7	=	18.41	(80)
West	0.9x	0.3	x	1.56	x	24.49	x	0.63	x	0.7	=	4.55	(80)
West	0.9x	0.77	x	2.46	x	16.15	x	0.63	x	0.7	=	12.14	(80)
West	0.9x	0.3	x	1.56	x	16.15	x	0.63	x	0.7	=	3	(80)

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

(83)m=	20.24	39.59	65.2	95.09	116.53	119.29	113.57	97.56	75.83	46.98	25.23	16.64	(83)

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

(84)m=	296.87	314.65	332.04	348.92	357.56	347.7	333.62	321.99	306.81	291.13	284.46	286.78	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.96	0.89	0.74	0.57	0.61	0.84	0.96	0.99	1	(86)

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

(87)m=	19.86	19.97	20.18	20.49	20.76	20.93	20.99	20.98	20.87	20.54	20.16	19.84	(87)

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

(88)m=	19.93	19.94	19.94	19.95	19.96	19.97	19.97	19.97	19.96	19.96	19.95	19.94	(88)

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

(89)m=	0.99	0.99	0.98	0.94	0.85	0.65	0.45	0.49	0.76	0.95	0.99	0.99	(89)

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

(90)m=	18.43	18.59	18.91	19.35	19.71	19.92	19.96	19.96	19.86	19.44	18.88	18.42	(90)

fLA = Living area ÷ (4) = 0.69 (91)

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

(92)m=	19.42	19.55	19.79	20.14	20.44	20.63	20.67	20.67	20.56	20.21	19.77	19.41	(92)

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

(93)m=	19.42	19.55	19.79	20.14	20.44	20.63	20.67	20.67	20.56	20.21	19.77	19.41	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.71	0.53	0.57	0.81	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	294.35	310.75	324.46	330.53	312.06	248.06	178	184.59	248.69	276.97	280.15	284.7	(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=	702.1	677.91	613.25	510.44	395.69	269.15	181.94	190.21	290.31	435	577.14	697.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	303.37	246.73	214.85	129.54	62.22	0	0	0	0	117.58	213.83	306.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.9 (98)

Space heating requirement in kWh/m²/year 40.69 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	303.37	246.73	214.85	129.54	62.22	0	0	0	0	117.58	213.83	306.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	324.46	263.88	229.79	138.54	66.55	0	0	0	0	125.75	228.69	328.11	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1705.77 (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)

156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6

Efficiency of water heater 79.8 (216)

(217)m=	86.56	86.35	85.85	84.78	82.99	79.8	79.8	79.8	79.8	84.43	85.89	86.64	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.29	159.6	169.34	154.77	155.72	145.87	141.2	153.41	152.66	161.11	166.15	176.13

Total = Sum(219a)$_{1...12}$ = 1916.25 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1705.77	
Water heating fuel used		1916.25	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		199.78	(232)

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

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	368.45	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	413.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =			782.36	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	103.68	(268)
Total CO2, kg/year		sum of (265)…(271) =		924.97	(272)

TER = 23.6 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B76_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.5	(1a) x	2.8	(2a) =	211.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.3	=	3.12			(26)
Windows Type 1			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 6			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	60.48	28.2	32.28	x	0.15	=	4.84			(29)
Walls Type2	20.16	0	20.16	x	0.14	=	2.85			(29)
Roof	75.5	0	75.5	x	0.1	=	7.55			(30)
Total area of elements, m²			156.14							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

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

Total fabric heat loss (33) + (36) = 58.03 (37)

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DER WorkSheet: New dwelling design stage

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.54	19.32	19.09	17.98	17.76	16.65	16.65	16.42	17.09	17.76	18.2	18.65	(38)

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

(39)m=	77.56	77.34	77.12	76.01	75.79	74.67	74.67	74.45	75.12	75.79	76.23	76.68	

Average = Sum(39)$_{1...12}$ /12= 75.95 (39)

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

(40)m=	1.03	1.02	1.02	1.01	1	0.99	0.99	0.99	0.99	1	1.01	1.02	

Average = Sum(40)$_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (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 90.53 (43)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	99.59	95.97	92.34	88.72	85.1	81.48	81.48	85.1	88.72	92.34	95.97	99.59	

Total = Sum(44)$_{1...12}$ = 1086.4 (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=	147.68	129.17	133.29	116.2	111.5	96.22	89.16	102.31	103.53	120.66	131.71	143.02	

Total = Sum(45)$_{1...12}$ = 1424.45 (45)

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

(46)m=	22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.35	15.53	18.1	19.76	21.45	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	202.96	179.09	188.56	169.7	166.78	149.71	144.43	157.59	157.03	175.93	185.2	198.3	(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=	202.96	179.09	188.56	169.7	166.78	149.71	144.43	157.59	157.03	175.93	185.2	198.3

Output from water heater (annual)$_{1...12}$ — 2075.29 (64)

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

(65)m=	93.33	82.89	88.54	81.43	81.3	74.79	73.87	78.24	77.22	84.34	86.59	91.78	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	(66)

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

(67)m=	18.7	16.61	13.51	10.23	7.64	6.45	6.97	9.06	12.17	15.45	18.03	19.22	(67)

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

(68)m=	209.78	211.96	206.47	194.79	180.05	166.2	156.94	154.76	160.25	171.93	186.67	200.52	(68)

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

(69)m=	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	(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=	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	(71)

Water heating gains (Table 5)

(72)m=	125.44	123.35	119	113.1	109.27	103.87	99.28	105.16	107.25	113.36	120.26	123.36	(72)

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

(73)m=	412.5	410.49	397.56	376.7	355.54	335.1	321.78	327.57	338.24	359.31	383.54	401.68	(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 m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

DER WorkSheet: New dwelling design stage

Northeast	0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast	0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast	0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast	0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast	0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)
Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)
Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)

East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
South	0.9x	0.77	x	2.6	x	46.75	x	0.53	x	0.7	=	62.5	(78)
South	0.9x	0.77	x	2.6	x	76.57	x	0.53	x	0.7	=	102.37	(78)
South	0.9x	0.77	x	2.6	x	97.53	x	0.53	x	0.7	=	130.4	(78)
South	0.9x	0.77	x	2.6	x	110.23	x	0.53	x	0.7	=	147.38	(78)
South	0.9x	0.77	x	2.6	x	114.87	x	0.53	x	0.7	=	153.58	(78)
South	0.9x	0.77	x	2.6	x	110.55	x	0.53	x	0.7	=	147.8	(78)
South	0.9x	0.77	x	2.6	x	108.01	x	0.53	x	0.7	=	144.4	(78)
South	0.9x	0.77	x	2.6	x	104.89	x	0.53	x	0.7	=	140.24	(78)
South	0.9x	0.77	x	2.6	x	101.89	x	0.53	x	0.7	=	136.21	(78)
South	0.9x	0.77	x	2.6	x	82.59	x	0.53	x	0.7	=	110.41	(78)
South	0.9x	0.77	x	2.6	x	55.42	x	0.53	x	0.7	=	74.09	(78)
South	0.9x	0.77	x	2.6	x	40.4	x	0.53	x	0.7	=	54.01	(78)

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

(83)m=	146.93	267.97	404.9	551.53	652.92	660.9	632.1	556.34	456.62	307.32	179.42	123.4	(83)

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

(84)m=	559.43	678.46	802.46	928.23	1008.46	996	953.87	883.91	794.86	666.63	562.96	525.08	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.84	0.67	0.48	0.34	0.39	0.63	0.91	0.99	1	(86)

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

(87)m=	20.06	20.26	20.55	20.83	20.96	21	21	21	20.98	20.77	20.36	20.02	(87)

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

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07	(88)

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

(89)m=	0.99	0.98	0.93	0.81	0.61	0.41	0.27	0.31	0.56	0.88	0.98	0.99	(89)

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

(90)m=	18.82	19.11	19.51	19.89	20.05	20.09	20.09	20.09	20.07	19.83	19.26	18.77	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	19.36	19.62	19.96	20.3	20.44	20.48	20.49	20.49	20.47	20.24	19.74	19.32	(92)

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

(93)m=	19.36	19.62	19.96	20.3	20.44	20.48	20.49	20.49	20.47	20.24	19.74	19.32	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.82	0.63	0.44	0.3	0.34	0.59	0.88	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	554.33	662.13	748.64	759.07	639.72	437.03	290.06	303.94	467.13	589.81	550.96	521.55	(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=	1168.02	1138.15	1038.28	866.45	662.68	439.39	290.3	304.4	478.29	730.55	963.31	1159.2	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	456.59	319.88	215.49	77.31	17.08	0	0	0	0	104.71	296.89	474.42	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1962.37 (98)

Space heating requirement in kWh/m²/year 25.99 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers 1 (303a)

Fraction of total space heat from Community boilers (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.05 (306)

Space heating **kWh/year**

Annual space heating requirement 1962.37

Space heat from Community boilers (98) x (304a) x (305) x (306) = 2060.49 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2075.29	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	2179.05	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	42.4	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		196.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	196.65	(331)
Energy for lighting (calculated in Appendix L)		330.28	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	1017.49	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	22	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1039.49	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				1039.49	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	102.06	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	171.42	(379)
Total CO2, kg/year	sum of (376)…(382) =				1312.97	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				17.39	(384)
EI rating (section 14)					85.4	(385)

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User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: B76_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.5	(1a) x	2.8	(2a) =	211.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.4	(5)

2. Ventilation rate:

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

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(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

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

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

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.2	=	2.88			(26)
Windows Type 1			1.53	x1/[1/(1.4)+ 0.04]		=	2.03			(27)
Windows Type 2			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 3			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 4			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 5			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 6			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Walls Type1	60.48	18.87	41.61	x	0.18	=	7.49			(29)
Walls Type2	20.16	0	20.16	x	0.18	=	3.63			(29)
Roof	75.5	0	75.5	x	0.13	=	9.81			(30)
Total area of elements, m²			156.14							(31)

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 45.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

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

Total fabric heat loss (33) + (36) = 53.43 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.17	40.93	40.69	39.56	39.35	38.37	38.37	38.19	38.75	39.35	39.78	40.23	(38)

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

(39)m=	94.6	94.36	94.12	92.99	92.78	91.8	91.8	91.62	92.18	92.78	93.21	93.65	

Average = Sum(39)$_{1...12}$ /12= 92.99 (39)

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

(40)m=	1.25	1.25	1.25	1.23	1.23	1.22	1.22	1.21	1.22	1.23	1.23	1.24	

Average = Sum(40)$_{1...12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

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

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (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 90.53 (43)

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

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

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

(44)m=	99.59	95.97	92.34	88.72	85.1	81.48	81.48	85.1	88.72	92.34	95.97	99.59	

Total = Sum(44)$_{1...12}$ = 1086.4 (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=	147.68	129.17	133.29	116.2	111.5	96.22	89.16	102.31	103.53	120.66	131.71	143.02	

Total = Sum(45)$_{1...12}$ = 1424.45 (45)

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

(46)m=	22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.35	15.53	18.1	19.76	21.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62	(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=	194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62

Output from water heater (annual)$_{1…12}$ | 1973.06 | (64)

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

(65)m=	86.38	76.62	81.59	74.71	74.35	68.07	66.92	71.29	70.5	77.39	79.87	84.83	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	(66)

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

(67)m=	18.7	16.61	13.51	10.23	7.64	6.45	6.97	9.06	12.17	15.45	18.03	19.22	(67)

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

(68)m=	209.78	211.96	206.47	194.79	180.05	166.2	156.94	154.76	160.25	171.93	186.67	200.52	(68)

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

(69)m=	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	(71)

Water heating gains (Table 5)

(72)m=	116.1	114.01	109.67	103.77	99.93	94.54	89.95	95.83	97.91	104.02	110.92	114.02	(72)

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

(73)m=	406.16	404.16	391.23	370.36	349.21	328.76	315.44	321.23	331.91	352.98	377.2	395.35	(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)

Northeast	0.9x	0.3	x	1.53	x	11.28	x	0.63	x	0.7	=	2.06	(75)
Northeast	0.9x	0.3	x	1.66	x	11.28	x	0.63	x	0.7	=	2.23	(75)
Northeast	0.9x	0.3	x	1.53	x	22.97	x	0.63	x	0.7	=	4.18	(75)
Northeast	0.9x	0.3	x	1.66	x	22.97	x	0.63	x	0.7	=	4.54	(75)
Northeast	0.9x	0.3	x	1.53	x	41.38	x	0.63	x	0.7	=	7.54	(75)
Northeast	0.9x	0.3	x	1.66	x	41.38	x	0.63	x	0.7	=	8.18	(75)
Northeast	0.9x	0.3	x	1.53	x	67.96	x	0.63	x	0.7	=	12.38	(75)
Northeast	0.9x	0.3	x	1.66	x	67.96	x	0.63	x	0.7	=	13.43	(75)
Northeast	0.9x	0.3	x	1.53	x	91.35	x	0.63	x	0.7	=	16.64	(75)
Northeast	0.9x	0.3	x	1.66	x	91.35	x	0.63	x	0.7	=	18.06	(75)
Northeast	0.9x	0.3	x	1.53	x	97.38	x	0.63	x	0.7	=	17.74	(75)
Northeast	0.9x	0.3	x	1.66	x	97.38	x	0.63	x	0.7	=	19.25	(75)
Northeast	0.9x	0.3	x	1.53	x	91.1	x	0.63	x	0.7	=	16.6	(75)
Northeast	0.9x	0.3	x	1.66	x	91.1	x	0.63	x	0.7	=	18.01	(75)
Northeast	0.9x	0.3	x	1.53	x	72.63	x	0.63	x	0.7	=	13.23	(75)
Northeast	0.9x	0.3	x	1.66	x	72.63	x	0.63	x	0.7	=	14.36	(75)
Northeast	0.9x	0.3	x	1.53	x	50.42	x	0.63	x	0.7	=	9.19	(75)
Northeast	0.9x	0.3	x	1.66	x	50.42	x	0.63	x	0.7	=	9.97	(75)
Northeast	0.9x	0.3	x	1.53	x	28.07	x	0.63	x	0.7	=	5.11	(75)
Northeast	0.9x	0.3	x	1.66	x	28.07	x	0.63	x	0.7	=	5.55	(75)
Northeast	0.9x	0.3	x	1.53	x	14.2	x	0.63	x	0.7	=	2.59	(75)
Northeast	0.9x	0.3	x	1.66	x	14.2	x	0.63	x	0.7	=	2.81	(75)
Northeast	0.9x	0.3	x	1.53	x	9.21	x	0.63	x	0.7	=	1.68	(75)
Northeast	0.9x	0.3	x	1.66	x	9.21	x	0.63	x	0.7	=	1.82	(75)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)
East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)

East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
South	0.9x	0.77	x	1.66	x	46.75	x	0.63	x	0.7	=	47.44	(78)
South	0.9x	0.77	x	1.66	x	76.57	x	0.63	x	0.7	=	77.69	(78)
South	0.9x	0.77	x	1.66	x	97.53	x	0.63	x	0.7	=	98.96	(78)
South	0.9x	0.77	x	1.66	x	110.23	x	0.63	x	0.7	=	111.85	(78)
South	0.9x	0.77	x	1.66	x	114.87	x	0.63	x	0.7	=	116.55	(78)
South	0.9x	0.77	x	1.66	x	110.55	x	0.63	x	0.7	=	112.17	(78)
South	0.9x	0.77	x	1.66	x	108.01	x	0.63	x	0.7	=	109.59	(78)
South	0.9x	0.77	x	1.66	x	104.89	x	0.63	x	0.7	=	106.43	(78)
South	0.9x	0.77	x	1.66	x	101.89	x	0.63	x	0.7	=	103.38	(78)
South	0.9x	0.77	x	1.66	x	82.59	x	0.63	x	0.7	=	83.79	(78)
South	0.9x	0.77	x	1.66	x	55.42	x	0.63	x	0.7	=	56.23	(78)
South	0.9x	0.77	x	1.66	x	40.4	x	0.63	x	0.7	=	40.99	(78)

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

(83)m=	111.51	203.36	307.28	418.55	495.49	501.55	479.69	422.2	346.53	233.22	136.16	93.65	(83)

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

(84)m=	517.67	607.52	698.5	788.92	844.7	830.31	795.13	743.43	678.44	586.2	513.37	489	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.5	0.55	0.8	0.96	0.99	1	(86)

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

(87)m=	19.7	19.88	20.17	20.53	20.81	20.95	20.99	20.98	20.89	20.51	20.04	19.67	(87)

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

(88)m=	19.88	19.88	19.88	19.89	19.9	19.91	19.91	19.91	19.9	19.9	19.89	19.89	(88)

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

(89)m=	1	0.99	0.97	0.91	0.78	0.57	0.38	0.43	0.72	0.94	0.99	1	(89)

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

(90)m=	18.16	18.43	18.84	19.35	19.72	19.88	19.9	19.9	19.82	19.34	18.66	18.13	(90)

fLA = Living area ÷ (4) = 0.44 (91)

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

(92)m=	18.83	19.06	19.42	19.86	20.19	20.35	20.38	20.37	20.28	19.85	19.26	18.8	(92)

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

(93)m=	18.83	19.06	19.42	19.86	20.19	20.35	20.38	20.37	20.28	19.85	19.26	18.8	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.8	0.61	0.43	0.48	0.75	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	514.37	599.3	675.76	720.69	672.88	504.15	343.13	358.09	507.67	552.24	506.78	486.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1374.9	1336.1	1216	1019.67	787.82	527.57	346.78	364.16	569.85	858.17	1133.66	1367.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	640.24	495.13	401.94	215.27	85.51	0	0	0	0	227.61	451.36	655.32	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 3172.37 (98)

Space heating requirement in kWh/m²/year 42.02 (99)

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

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	640.24	495.13	401.94	215.27	85.51	0	0	0	0	227.61	451.36	655.32	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	684.75	529.55	429.88	230.23	91.46	0	0	0	0	243.43	482.73	700.88	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 3392.91 (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)

194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62

Efficiency of water heater 79.8 (216)

(217)m=	87.76	87.49	86.9	85.58	83.26	79.8	79.8	79.8	79.8	85.64	87.21	87.86	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.37	195.75	207.01	188.46	189.89	177.08	170.12	186.6	186.25	195.3	202.73	215.83

Total = Sum(219a)$_{1...12}$ = 2336.38 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		3392.91	
Water heating fuel used		2336.38	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year — sum of (230a)…(230g) =		75	(231)
Electricity for lighting		330.28	(232)

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

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	732.87	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	504.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1237.53	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.41	(268)
Total CO2, kg/year			sum of (265)…(271) =		1447.87	(272)

TER = 19.18 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B79_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52	(1a) x	2.8	(2a) =	145.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

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

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

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

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

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

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

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

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

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

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.4	x	1.3	=	3.12			(26)
Doors Type 2			2.5	x	1.3	=	3.25			(26)
Windows Type 1			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	33.32	12.5	20.82	x	0.15	=	3.12			(29)
Walls Type2	11.48	0	11.48	x	0.14	=	1.62			(29)
Roof	52	0	52	x	0.1	=	5.2			(30)
Total area of elements, m²			96.8							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.84 (36)

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

Total fabric heat loss (33) + (36) = 30.55 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.46	13.3	13.15	12.38	12.23	11.47	11.47	11.31	11.77	12.23	12.54	12.84	(38)

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

(39)m=	44.01	43.85	43.7	42.93	42.78	42.01	42.01	41.86	42.32	42.78	43.09	43.39	

Average = Sum(39)$_{1…12}$ /12= 42.9 (39)

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

(40)m=	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.81	0.81	0.82	0.83	0.83

Average = Sum(40)$_{1...12}$ /12= 0.82 (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 1.75 (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 75.74 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31	

Total = Sum(44)$_{1...12}$ = 908.89 (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=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65

Total = Sum(45)$_{1...12}$ = 1191.69 (45)

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

(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

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

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

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

Water storage loss:

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

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

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

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

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

(56)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(56)

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

(57)m=	32.01	28.92	32.01	30.98	32.01	30.98	32.01	32.01	30.98	32.01	30.98	32.01	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	(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=	178.83	157.99	166.79	150.71	148.56	133.99	129.87	140.87	140.11	156.22	163.68	174.93	

Output from water heater (annual)$_{1…12}$ 1842.53 (64)

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

(65)m=	85.3	75.87	81.3	75.12	75.24	69.56	69.02	72.68	71.59	77.78	79.43	84.01	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)

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

(67)m=	14.31	12.71	10.33	7.82	5.85	4.94	5.34	6.93	9.31	11.82	13.79	14.7	(67)

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

(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)

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

(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(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=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)

Water heating gains (Table 5)

(72)m=	114.65	112.9	109.27	104.33	101.13	96.61	92.77	97.69	99.44	104.55	110.32	112.91	(72)

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

(73)m=	330.62	328.86	318.86	302.93	287.04	271.54	261.38	266.31	274.42	290.53	308.99	322.55	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
South	0.9x	0.3	x	2.6	x	46.75	x	0.53	x	0.7	=	12.18	(78)
South	0.9x	0.3	x	2.6	x	76.57	x	0.53	x	0.7	=	19.94	(78)
South	0.9x	0.3	x	2.6	x	97.53	x	0.53	x	0.7	=	25.4	(78)
South	0.9x	0.3	x	2.6	x	110.23	x	0.53	x	0.7	=	28.71	(78)
South	0.9x	0.3	x	2.6	x	114.87	x	0.53	x	0.7	=	29.92	(78)

South	0.9x	0.3	x	2.6	x	110.55	x	0.53	x	0.7	=	28.79	(78)
South	0.9x	0.3	x	2.6	x	108.01	x	0.53	x	0.7	=	28.13	(78)
South	0.9x	0.3	x	2.6	x	104.89	x	0.53	x	0.7	=	27.32	(78)
South	0.9x	0.3	x	2.6	x	101.89	x	0.53	x	0.7	=	26.54	(78)
South	0.9x	0.3	x	2.6	x	82.59	x	0.53	x	0.7	=	21.51	(78)
South	0.9x	0.3	x	2.6	x	55.42	x	0.53	x	0.7	=	14.43	(78)
South	0.9x	0.3	x	2.6	x	40.4	x	0.53	x	0.7	=	10.52	(78)
Southwest	0.9x	0.3	x	2.4	x	36.79		0.53	x	0.7	=	8.85	(79)
Southwest	0.9x	0.3	x	2.4	x	62.67		0.53	x	0.7	=	15.07	(79)
Southwest	0.9x	0.3	x	2.4	x	85.75		0.53	x	0.7	=	20.62	(79)
Southwest	0.9x	0.3	x	2.4	x	106.25		0.53	x	0.7	=	25.54	(79)
Southwest	0.9x	0.3	x	2.4	x	119.01		0.53	x	0.7	=	28.61	(79)
Southwest	0.9x	0.3	x	2.4	x	118.15		0.53	x	0.7	=	28.4	(79)
Southwest	0.9x	0.3	x	2.4	x	113.91		0.53	x	0.7	=	27.38	(79)
Southwest	0.9x	0.3	x	2.4	x	104.39		0.53	x	0.7	=	25.1	(79)
Southwest	0.9x	0.3	x	2.4	x	92.85		0.53	x	0.7	=	22.32	(79)
Southwest	0.9x	0.3	x	2.4	x	69.27		0.53	x	0.7	=	16.65	(79)
Southwest	0.9x	0.3	x	2.4	x	44.07		0.53	x	0.7	=	10.59	(79)
Southwest	0.9x	0.3	x	2.4	x	31.49		0.53	x	0.7	=	7.57	(79)
West	0.9x	0.3	x	2.6	x	19.64	x	0.53	x	0.7	=	5.12	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.53	x	0.7	=	10.01	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.53	x	0.7	=	16.48	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.53	x	0.7	=	24.03	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.53	x	0.7	=	29.45	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.53	x	0.7	=	30.15	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.53	x	0.7	=	28.71	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.53	x	0.7	=	24.66	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.53	x	0.7	=	19.17	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.53	x	0.7	=	11.87	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.53	x	0.7	=	6.38	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.53	x	0.7	=	4.21	(80)

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

(83)m=	26.14	45.02	62.5	78.29	87.98	87.35	84.22	77.07	68.02	50.03	31.41	22.3	(83)

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

(84)m=	356.76	373.87	381.36	381.22	375.02	358.89	345.6	343.38	342.44	340.56	340.39	344.85	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.96	0.89	0.72	0.53	0.56	0.79	0.95	0.99	1	(86)

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

(87)m=	20.27	20.36	20.51	20.71	20.88	20.98	21	21	20.96	20.77	20.5	20.26	(87)

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

(88)m=	20.21	20.22	20.22	20.23	20.23	20.25	20.25	20.25	20.24	20.23	20.23	20.22	(88)

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

(89)m=	0.99	0.99	0.98	0.95	0.86	0.65	0.44	0.47	0.73	0.94	0.99	0.99	(89)

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

(90)m=	19.25	19.37	19.59	19.88	20.11	20.23	20.25	20.25	20.21	19.97	19.58	19.24	(90)

fLA = Living area ÷ (4) = 0.56 (91)

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

(92)m=	19.82	19.93	20.1	20.34	20.54	20.65	20.67	20.67	20.63	20.42	20.1	19.81	(92)

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

(93)m=	19.82	19.93	20.1	20.34	20.54	20.65	20.67	20.67	20.63	20.42	20.1	19.81	(93)

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.69	0.49	0.52	0.76	0.94	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	354.19	369.72	373.47	362.53	327.25	246.42	170.15	177.62	260.64	320.46	335.25	342.8	(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=	683.09	658.92	594.43	491.35	378.27	254.25	170.91	178.67	276.39	420.08	559.95	677.42	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	244.7	194.34	164.39	92.75	37.96	0	0	0	0	74.12	161.79	248.96	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1219 (98)

Space heating requirement in kWh/m²/year 23.44 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community boilers		1	(303a)
Fraction of total space heat from Community boilers	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.05	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1219	
Space heat from Community boilers	(98) x (304a) x (305) x (306) =	1279.95	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1842.53	
If DHW from community scheme: Water heat from Community boilers	(64) x (303a) x (305) x (306) =	1934.66	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	32.15	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		135.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	135.44	(331)
Energy for lighting (calculated in Appendix L)		252.67	(332)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				90	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.22	=	771.51	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.68	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	788.19	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.22	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				788.19	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	70.3	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	131.14	(379)
Total CO2, kg/year	sum of (376)…(382) =				989.62	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				19.03	(384)
EI rating (section 14)					86.33	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B79_Be Lean

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52	(1a) x	2.8	(2a) =	145.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

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

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

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

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

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

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

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

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

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

(24d)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

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

(25)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.4	x	1.2	=	2.88			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			2.4		x1/[1/(1.4)+ 0.04]	=	3.18			(27)
Windows Type 2			2.6		x1/[1/(1.4)+ 0.04]	=	3.45			(27)
Windows Type 3			2.6		x1/[1/(1.4)+ 0.04]	=	3.45			(27)
Walls Type1	33.32	12.5	20.82	x	0.18	=	3.75			(29)
Walls Type2	11.48	0	11.48	x	0.18	=	2.07			(29)
Roof	52	0	52	x	0.13	=	6.76			(30)
Total area of elements, m²			96.8							(31)

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

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

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

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

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.84 (36)

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

Total fabric heat loss (33) + (36) = 33.37 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.26	28.09	27.93	27.18	27.03	26.37	26.37	26.25	26.63	27.03	27.32	27.62	(38)

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

(39)m=	61.63	61.46	61.3	60.55	60.4	59.74	59.74	59.62	60	60.4	60.69	60.99	

Average = Sum(39)$_{1\ldots12}$ /12= 60.54 (39)

TER WorkSheet: New dwelling design stage

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

(40)m=	1.19	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17

Average = Sum(40)$_{1…12}$ /12= 1.16 (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 1.75 (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 75.74 (43)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31	
										Total = Sum(44)$_{1…12}$ =		908.89	(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=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65	
										Total = Sum(45)$_{1…12}$ =		1191.69	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

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

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

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

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	(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=	170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25

Output from water heater (annual)1…12 | 1740.31 | (64)

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

(65)m=	78.36	69.6	74.35	68.4	68.29	62.84	62.08	65.74	64.87	70.84	72.71	77.06	(65)

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

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

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)

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

(67)m=	14.31	12.71	10.33	7.82	5.85	4.94	5.34	6.93	9.31	11.82	13.79	14.7	(67)

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

(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)

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

(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

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

(71)m=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)

Water heating gains (Table 5)

(72)m=	105.32	103.57	99.94	95	91.79	87.27	83.44	88.35	90.1	95.21	100.99	103.58	(72)

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

(73)m=	324.29	322.52	312.53	296.59	280.7	265.21	255.04	259.98	268.08	284.19	302.65	316.22	(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)	
South	0.9x	0.3	x	2.6	x	46.75	x	0.63	x	0.7	=	14.47	(78)
South	0.9x	0.3	x	2.6	x	76.57	x	0.63	x	0.7	=	23.7	(78)
South	0.9x	0.3	x	2.6	x	97.53	x	0.63	x	0.7	=	30.19	(78)
South	0.9x	0.3	x	2.6	x	110.23	x	0.63	x	0.7	=	34.13	(78)
South	0.9x	0.3	x	2.6	x	114.87	x	0.63	x	0.7	=	35.56	(78)

South	0.9x	0.3	x	2.6	x	110.55	x	0.63	x	0.7	=	34.22	(78)
South	0.9x	0.3	x	2.6	x	108.01	x	0.63	x	0.7	=	33.44	(78)
South	0.9x	0.3	x	2.6	x	104.89	x	0.63	x	0.7	=	32.47	(78)
South	0.9x	0.3	x	2.6	x	101.89	x	0.63	x	0.7	=	31.54	(78)
South	0.9x	0.3	x	2.6	x	82.59	x	0.63	x	0.7	=	25.57	(78)
South	0.9x	0.3	x	2.6	x	55.42	x	0.63	x	0.7	=	17.16	(78)
South	0.9x	0.3	x	2.6	x	40.4	x	0.63	x	0.7	=	12.51	(78)
Southwest	0.9x	0.3	x	2.4	x	36.79		0.63	x	0.7	=	10.51	(79)
Southwest	0.9x	0.3	x	2.4	x	62.67		0.63	x	0.7	=	17.91	(79)
Southwest	0.9x	0.3	x	2.4	x	85.75		0.63	x	0.7	=	24.51	(79)
Southwest	0.9x	0.3	x	2.4	x	106.25		0.63	x	0.7	=	30.36	(79)
Southwest	0.9x	0.3	x	2.4	x	119.01		0.63	x	0.7	=	34.01	(79)
Southwest	0.9x	0.3	x	2.4	x	118.15		0.63	x	0.7	=	33.76	(79)
Southwest	0.9x	0.3	x	2.4	x	113.91		0.63	x	0.7	=	32.55	(79)
Southwest	0.9x	0.3	x	2.4	x	104.39		0.63	x	0.7	=	29.83	(79)
Southwest	0.9x	0.3	x	2.4	x	92.85		0.63	x	0.7	=	26.53	(79)
Southwest	0.9x	0.3	x	2.4	x	69.27		0.63	x	0.7	=	19.79	(79)
Southwest	0.9x	0.3	x	2.4	x	44.07		0.63	x	0.7	=	12.59	(79)
Southwest	0.9x	0.3	x	2.4	x	31.49		0.63	x	0.7	=	9	(79)
West	0.9x	0.3	x	2.6	x	19.64	x	0.63	x	0.7	=	6.08	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.63	x	0.7	=	11.89	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.63	x	0.7	=	19.59	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.63	x	0.7	=	28.57	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.63	x	0.7	=	35.01	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.63	x	0.7	=	35.84	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.63	x	0.7	=	34.12	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.63	x	0.7	=	29.31	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.63	x	0.7	=	22.78	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.63	x	0.7	=	14.11	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.63	x	0.7	=	7.58	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.63	x	0.7	=	5	(80)

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

(83)m=	31.07	53.51	74.29	93.06	104.58	103.83	100.11	91.61	80.86	59.48	37.33	26.5	(83)

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

(84)m=	355.36	376.03	386.82	389.65	385.28	369.03	355.15	351.59	348.94	343.67	339.98	342.72	(84)

7. Mean internal temperature (heating season)

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

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.98	0.95	0.85	0.69	0.72	0.9	0.98	0.99	1	(86)

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

(87)m=	19.79	19.89	20.09	20.37	20.64	20.87	20.97	20.96	20.82	20.47	20.09	19.77	(87)

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

(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)

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

(89)m=	1	0.99	0.99	0.97	0.92	0.77	0.55	0.58	0.84	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.49	18.77	19.18	19.57	19.87	19.95	19.94	19.8	19.34	18.78	18.31	(90)

fLA = Living area ÷ (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.28	19.51	19.85	20.17	20.43	20.52	20.51	20.37	19.97	19.51	19.13	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.28	19.51	19.85	20.17	20.43	20.52	20.51	20.37	19.97	19.51	19.13	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.99	0.97	0.93	0.81	0.63	0.66	0.86	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.25	372.77	381.11	377.74	357	298.67	223.52	231.67	301.29	331.87	336.37	341.02	(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=	915.09	883.66	797.77	662.82	511.85	348.45	234.22	245.32	376.26	566.24	753.44	910.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	418.01	343.32	310	205.26	115.21	0	0	0	0	174.37	300.3	423.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2290.29 (98)

Space heating requirement in kWh/m²/year 44.04 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	418.01	343.32	310	205.26	115.21	0	0	0	0	174.37	300.3	423.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	447.07	367.18	331.55	219.53	123.22	0	0	0	0	186.5	321.17	453.29	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2449.51 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

	170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	
Efficiency of water heater													79.8 (216)
(217)m=	87.12	86.95	86.58	85.79	84.3	79.8	79.8	79.8	79.8	85.26	86.54	87.21	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.3	172.68	182.61	165.88	165.92	157.38	151.86	165.65	165.05	173.04	179.42	190.64

Total = Sum(219a)$_{1...12}$ = 2065.42 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2449.51	
Water heating fuel used			2065.42	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			252.67	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	529.09	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	446.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =				975.23	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	131.14	(268)
Total CO2, kg/year			sum of (265)…(271) =		1145.29	(272)

TER = 22.02 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: C84_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.5	(1a) x	2.8	(2a) =	343	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	343	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

		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		3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)		0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.3	=	2.73			(26)
Doors Type 2			4	x	1.3	=	5.2			(26)
Doors Type 3			2.3	x	1	=	2.3			(26)
Windows Type 1			3.2		x1/[1/(1.3)+ 0.04]	=	3.95			(27)
Windows Type 2			1.9		x1/[1/(1.3)+ 0.04]	=	2.35			(27)
Windows Type 3			4.3		x1/[1/(1.3)+ 0.04]	=	5.31			(27)
Windows Type 4			4		x1/[1/(1.3)+ 0.04]	=	4.94			(27)
Windows Type 5			3.3		x1/[1/(1.3)+ 0.04]	=	4.08			(27)
Windows Type 6			3.3		x1/[1/(1.3)+ 0.04]	=	4.08			(27)
Windows Type 7			1.3		x1/[1/(1.3)+ 0.04]	=	1.61			(27)
Floor			122.5	x	0.1	=	12.25			(28)
Walls	78.96	29.7	49.26	x	0.15	=	7.39			(29)
Total area of elements, m²			201.46							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 56.19 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 22834.4 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.07 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	66.26	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	31.7	31.34	30.98	29.17	28.81	27.01	27.01	26.65	27.73	28.81	29.54	30.26	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	97.96	97.6	97.24	95.43	95.07	93.27	93.27	92.91	93.99	95.07	95.8	96.52	

Average = Sum(39)$_{1...12}$ /12= 95.34 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.8	0.8	0.79	0.78	0.78	0.76	0.76	0.76	0.77	0.78	0.78	0.79	

Average = Sum(40)$_{1...12}$ /12= 0.78 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.42 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(44)m=	112.66	108.57	104.47	100.37	96.28	92.18	92.18	96.28	100.37	104.47	108.57	112.66	

Total = Sum(44)$_{1...12}$ = 1229.06 (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=	167.08	146.13	150.79	131.46	126.14	108.85	100.87	115.74	117.13	136.5	149	161.8	

Total = Sum(45)$_{1...12}$ = 1611.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.92	22.62	19.72	18.92	16.33	15.13	17.36	17.57	20.48	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	220.66	194.52	204.37	183.31	179.72	160.7	154.45	169.32	168.98	190.08	200.85	215.39	(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=	220.66	194.52	204.37	183.31	179.72	160.7	154.45	169.32	168.98	190.08	200.85	215.39	

Output from water heater (annual)1…12 | 2242.35 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	98.42	87.3	93	85.19	84.81	77.67	76.4	81.35	80.43	88.25	91.02	96.66	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.71	22.84	18.57	14.06	10.51	8.87	9.59	12.46	16.73	21.24	24.79	26.43	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.43	291.43	283.88	267.83	247.56	228.51	215.78	212.79	220.33	236.39	256.66	275.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(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=	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	(71)

Water heating gains (Table 5)

(72)m=	132.28	129.92	125	118.32	113.99	107.88	102.69	109.34	111.7	118.62	126.42	129.93	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	512.51	510.27	493.55	466.3	438.14	411.35	394.15	400.68	414.85	442.33	473.96	498.15	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

DER WorkSheet: New dwelling design stage

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.63	x	0.53	x	0.7	=	8.75	(74)
North	0.9x	0.77	x	1.9	x	10.63	x	0.53	x	0.7	=	5.19	(74)
North	0.9x	0.77	x	4.3	x	10.63	x	0.53	x	0.7	=	11.76	(74)
North	0.9x	0.77	x	4	x	10.63	x	0.53	x	0.7	=	10.94	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.53	x	0.7	=	9.02	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.53	x	0.7	=	9.02	(74)
North	0.9x	0.77	x	1.3	x	10.63	x	0.53	x	0.7	=	3.55	(74)
North	0.9x	0.77	x	3.2	x	20.32	x	0.53	x	0.7	=	16.72	(74)
North	0.9x	0.77	x	1.9	x	20.32	x	0.53	x	0.7	=	9.93	(74)
North	0.9x	0.77	x	4.3	x	20.32	x	0.53	x	0.7	=	22.47	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.53	x	0.7	=	20.9	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.53	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.53	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.53	x	0.7	=	6.79	(74)
North	0.9x	0.77	x	3.2	x	34.53	x	0.53	x	0.7	=	28.41	(74)
North	0.9x	0.77	x	1.9	x	34.53	x	0.53	x	0.7	=	16.87	(74)
North	0.9x	0.77	x	4.3	x	34.53	x	0.53	x	0.7	=	38.17	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.53	x	0.7	=	35.51	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.53	x	0.7	=	29.3	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.53	x	0.7	=	29.3	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.53	x	0.7	=	11.54	(74)
North	0.9x	0.77	x	3.2	x	55.46	x	0.53	x	0.7	=	45.63	(74)
North	0.9x	0.77	x	1.9	x	55.46	x	0.53	x	0.7	=	27.09	(74)
North	0.9x	0.77	x	4.3	x	55.46	x	0.53	x	0.7	=	61.32	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.53	x	0.7	=	57.04	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.53	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.53	x	0.7	=	47.06	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.53	x	0.7	=	18.54	(74)
North	0.9x	0.77	x	3.2	x	74.72	x	0.53	x	0.7	=	61.47	(74)
North	0.9x	0.77	x	1.9	x	74.72	x	0.53	x	0.7	=	36.5	(74)
North	0.9x	0.77	x	4.3	x	74.72	x	0.53	x	0.7	=	82.6	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.53	x	0.7	=	76.84	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.53	x	0.7	=	63.39	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.53	x	0.7	=	63.39	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.53	x	0.7	=	24.97	(74)
North	0.9x	0.77	x	3.2	x	79.99	x	0.53	x	0.7	=	65.81	(74)
North	0.9x	0.77	x	1.9	x	79.99	x	0.53	x	0.7	=	39.07	(74)
North	0.9x	0.77	x	4.3	x	79.99	x	0.53	x	0.7	=	88.43	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.53	x	0.7	=	82.26	(74)

DER WorkSheet: New dwelling design stage

North	0.9x	0.77	x	3.3	x	79.99	x	0.53	x	0.7	=	67.86	(74)
North	0.9x	0.77	x	3.3	x	79.99	x	0.53	x	0.7	=	67.86	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.53	x	0.7	=	26.73	(74)
North	0.9x	0.77	x	3.2	x	74.68	x	0.53	x	0.7	=	61.44	(74)
North	0.9x	0.77	x	1.9	x	74.68	x	0.53	x	0.7	=	36.48	(74)
North	0.9x	0.77	x	4.3	x	74.68	x	0.53	x	0.7	=	82.56	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.53	x	0.7	=	76.8	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.53	x	0.7	=	63.36	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.53	x	0.7	=	63.36	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.53	x	0.7	=	24.96	(74)
North	0.9x	0.77	x	3.2	x	59.25	x	0.53	x	0.7	=	48.74	(74)
North	0.9x	0.77	x	1.9	x	59.25	x	0.53	x	0.7	=	28.94	(74)
North	0.9x	0.77	x	4.3	x	59.25	x	0.53	x	0.7	=	65.5	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.53	x	0.7	=	60.93	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.53	x	0.7	=	50.27	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.53	x	0.7	=	50.27	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.53	x	0.7	=	19.8	(74)
North	0.9x	0.77	x	3.2	x	41.52	x	0.53	x	0.7	=	34.16	(74)
North	0.9x	0.77	x	1.9	x	41.52	x	0.53	x	0.7	=	20.28	(74)
North	0.9x	0.77	x	4.3	x	41.52	x	0.53	x	0.7	=	45.9	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.53	x	0.7	=	42.7	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.53	x	0.7	=	35.22	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.53	x	0.7	=	35.22	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.53	x	0.7	=	13.88	(74)
North	0.9x	0.77	x	3.2	x	24.19	x	0.53	x	0.7	=	19.9	(74)
North	0.9x	0.77	x	1.9	x	24.19	x	0.53	x	0.7	=	11.82	(74)
North	0.9x	0.77	x	4.3	x	24.19	x	0.53	x	0.7	=	26.74	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.53	x	0.7	=	24.88	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.53	x	0.7	=	20.52	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.53	x	0.7	=	20.52	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.53	x	0.7	=	8.08	(74)
North	0.9x	0.77	x	3.2	x	13.12	x	0.53	x	0.7	=	10.79	(74)
North	0.9x	0.77	x	1.9	x	13.12	x	0.53	x	0.7	=	6.41	(74)
North	0.9x	0.77	x	4.3	x	13.12	x	0.53	x	0.7	=	14.5	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.53	x	0.7	=	13.49	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.53	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.53	x	0.7	=	11.13	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.53	x	0.7	=	4.38	(74)
North	0.9x	0.77	x	3.2	x	8.86	x	0.53	x	0.7	=	7.29	(74)
North	0.9x	0.77	x	1.9	x	8.86	x	0.53	x	0.7	=	4.33	(74)
North	0.9x	0.77	x	4.3	x	8.86	x	0.53	x	0.7	=	9.8	(74)

North	0.9x	0.77	x	4	x	8.86	x	0.53	x	0.7	=	9.12	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.53	x	0.7	=	7.52	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.53	x	0.7	=	7.52	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.53	x	0.7	=	2.96	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	58.23	111.28	189.1	303.74	409.17	438.02	408.95	324.45	227.36	132.47	71.84	48.54	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	570.75	621.55	682.64	770.04	847.31	849.37	803.1	725.13	642.21	574.8	545.79	546.69	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.98	0.89	0.68	0.51	0.58	0.88	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.13	20.22	20.4	20.67	20.89	20.99	21	21	20.93	20.65	20.35	20.12	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.25	20.26	20.26	20.27	20.27	20.29	20.29	20.29	20.28	20.27	20.27	20.26	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.97	0.86	0.62	0.43	0.5	0.83	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.06	19.2	19.47	19.87	20.17	20.28	20.29	20.29	20.22	19.85	19.41	19.06	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.49	19.61	19.84	20.19	20.46	20.56	20.57	20.57	20.51	20.17	19.79	19.48	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.49	19.61	19.84	20.19	20.46	20.56	20.57	20.57	20.51	20.17	19.79	19.48	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.97	0.87	0.64	0.46	0.53	0.85	0.98	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	570.22	620.37	678.6	747.11	734.43	546.31	369.72	385.6	543.09	565.95	544.61	546.32	(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=	1488.17	1435.92	1297.52	1077.4	832.82	556.22	370.56	387.72	602.24	910.14	1215.42	1475.15	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	682.95	548.05	460.48	237.81	73.2	0	0	0	0	256.08	482.99	691.05	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3432.6 (98)

Space heating requirement in kWh/m²/year 28.02 (99)

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9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		3432.6	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	4290.75	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2242.35	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2802.94	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	70.94	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		319.08	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	319.08	(331)
Energy for lighting (calculated in Appendix L)		454.09	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-798.65	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	1154.12	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	36.82	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	1190.93	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)

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CO_2 associated with water from immersion heater or instantaneous heater	(312) x	0.52	=	0	(375)
Total CO_2 associated with space and water heating	(373) + (374) + (375) =			1190.93	(376)
CO_2 associated with electricity for pumps and fans within dwelling	(331)) x	0.52	=	165.6	(378)
CO_2 associated with electricity for lighting	(332))) x	0.52	=	235.67	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =	-414.5	(380)
Total CO_2, kg/year	sum of (376)…(382) =			1177.71	(383)
Dwelling CO_2 Emission Rate	(383) ÷ (4) =			9.61	(384)
EI rating (section 14)				90.58	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: C84_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	122.5	(1a) x	2.8	(2a) =	343	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	122.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	343	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							4	x 10 =	40	(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) =	40	÷ (5) =	0.12	(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)	0.37	(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) =	0.31	(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

0.4	0.39	0.38	0.34	0.33	0.3	0.3	0.29	0.31	0.33	0.35	0.37

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.58	0.58	0.57	0.56	0.56	0.54	0.54	0.54	0.55	0.56	0.56	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.1	x	1.2	=	2.52			(26)
Doors Type 2			4	x	1.2	=	4.8			(26)
Doors Type 3			2.3	x	1	=	2.3			(26)
Windows Type 1			3.2		x1/[1/(1.4)+ 0.04]	=	4.24			(27)
Windows Type 2			1.9		x1/[1/(1.4)+ 0.04]	=	2.52			(27)
Windows Type 3			4.3		x1/[1/(1.4)+ 0.04]	=	5.7			(27)
Windows Type 4			4		x1/[1/(1.4)+ 0.04]	=	5.3			(27)
Windows Type 5			3.3		x1/[1/(1.4)+ 0.04]	=	4.37			(27)
Windows Type 6			3.3		x1/[1/(1.4)+ 0.04]	=	4.37			(27)
Windows Type 7			1.3		x1/[1/(1.4)+ 0.04]	=	1.72			(27)
Floor			122.5	x	0.13	=	15.925			(28)
Walls	78.96	29.7	49.26	x	0.18	=	8.87			(29)
Total area of elements, m²			201.46							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 62.65 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 22834.4 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 10.07 (36)

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if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 72.72 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	65.53	65.18	64.84	63.25	62.95	61.56	61.56	61.3	62.09	62.95	63.55	64.18	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	138.25	137.9	137.56	135.97	135.67	134.28	134.28	134.02	134.81	135.67	136.27	136.9

Average = Sum(39)$_{1…12}$ /12= 135.96 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.1	1.1	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1…12}$ /12= 1.11 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.87 (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) + 36 102.42 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(44)m=	112.66	108.57	104.47	100.37	96.28	92.18	92.18	96.28	100.37	104.47	108.57	112.66

Total = Sum(44)$_{1…12}$ = 1229.06 (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=	167.08	146.13	150.79	131.46	126.14	108.85	100.87	115.74	117.13	136.5	149	161.8

Total = Sum(45)$_{1…12}$ = 1611.49 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	25.06	21.92	22.62	19.72	18.92	16.33	15.13	17.36	17.57	20.48	22.35	24.27	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4	(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=	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4

Output from water heater (annual)$_{1\ldots12}$ | 2160.1 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.83	82.26	87.41	79.78	79.22	72.27	70.81	75.76	75.02	82.66	85.62	91.08	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	143.62	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	25.71	22.84	18.57	14.06	10.51	8.87	9.59	12.46	16.73	21.24	24.79	26.43	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	288.43	291.43	283.88	267.83	247.56	228.51	215.78	212.79	220.33	236.39	256.66	275.71	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	37.36	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	-114.9	(71)

Water heating gains (Table 5)

(72)m=	124.77	122.4	117.49	110.81	106.48	100.37	95.18	101.83	104.19	111.11	118.91	122.41	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	508	505.76	489.03	461.79	433.63	406.84	389.64	396.17	410.34	437.82	469.45	493.63	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

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Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	3.2	x	10.63	x	0.63	x	0.7	=	10.4	(74)
North	0.9x	0.77	x	1.9	x	10.63	x	0.63	x	0.7	=	6.17	(74)
North	0.9x	0.77	x	4.3	x	10.63	x	0.63	x	0.7	=	13.97	(74)
North	0.9x	0.77	x	4	x	10.63	x	0.63	x	0.7	=	13	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.63	x	0.7	=	10.72	(74)
North	0.9x	0.77	x	3.3	x	10.63	x	0.63	x	0.7	=	10.72	(74)
North	0.9x	0.77	x	1.3	x	10.63	x	0.63	x	0.7	=	4.22	(74)
North	0.9x	0.77	x	3.2	x	20.32	x	0.63	x	0.7	=	19.87	(74)
North	0.9x	0.77	x	1.9	x	20.32	x	0.63	x	0.7	=	11.8	(74)
North	0.9x	0.77	x	4.3	x	20.32	x	0.63	x	0.7	=	26.7	(74)
North	0.9x	0.77	x	4	x	20.32	x	0.63	x	0.7	=	24.84	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.63	x	0.7	=	20.49	(74)
North	0.9x	0.77	x	3.3	x	20.32	x	0.63	x	0.7	=	20.49	(74)
North	0.9x	0.77	x	1.3	x	20.32	x	0.63	x	0.7	=	8.07	(74)
North	0.9x	0.77	x	3.2	x	34.53	x	0.63	x	0.7	=	33.77	(74)
North	0.9x	0.77	x	1.9	x	34.53	x	0.63	x	0.7	=	20.05	(74)
North	0.9x	0.77	x	4.3	x	34.53	x	0.63	x	0.7	=	45.38	(74)
North	0.9x	0.77	x	4	x	34.53	x	0.63	x	0.7	=	42.21	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.63	x	0.7	=	34.82	(74)
North	0.9x	0.77	x	3.3	x	34.53	x	0.63	x	0.7	=	34.82	(74)
North	0.9x	0.77	x	1.3	x	34.53	x	0.63	x	0.7	=	13.72	(74)
North	0.9x	0.77	x	3.2	x	55.46	x	0.63	x	0.7	=	54.24	(74)
North	0.9x	0.77	x	1.9	x	55.46	x	0.63	x	0.7	=	32.21	(74)
North	0.9x	0.77	x	4.3	x	55.46	x	0.63	x	0.7	=	72.89	(74)
North	0.9x	0.77	x	4	x	55.46	x	0.63	x	0.7	=	67.8	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	3.3	x	55.46	x	0.63	x	0.7	=	55.94	(74)
North	0.9x	0.77	x	1.3	x	55.46	x	0.63	x	0.7	=	22.04	(74)
North	0.9x	0.77	x	3.2	x	74.72	x	0.63	x	0.7	=	73.07	(74)
North	0.9x	0.77	x	1.9	x	74.72	x	0.63	x	0.7	=	43.38	(74)
North	0.9x	0.77	x	4.3	x	74.72	x	0.63	x	0.7	=	98.19	(74)
North	0.9x	0.77	x	4	x	74.72	x	0.63	x	0.7	=	91.34	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.63	x	0.7	=	75.35	(74)
North	0.9x	0.77	x	3.3	x	74.72	x	0.63	x	0.7	=	75.35	(74)
North	0.9x	0.77	x	1.3	x	74.72	x	0.63	x	0.7	=	29.68	(74)
North	0.9x	0.77	x	3.2	x	79.99	x	0.63	x	0.7	=	78.22	(74)
North	0.9x	0.77	x	1.9	x	79.99	x	0.63	x	0.7	=	46.44	(74)
North	0.9x	0.77	x	4.3	x	79.99	x	0.63	x	0.7	=	105.11	(74)
North	0.9x	0.77	x	4	x	79.99	x	0.63	x	0.7	=	97.78	(74)

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North	0.9x	0.77	x	3.3	x	79.99	x	0.63	x	0.7	=	80.67	(74)
North	0.9x	0.77	x	3.3	x	79.99	x	0.63	x	0.7	=	80.67	(74)
North	0.9x	0.77	x	1.3	x	79.99	x	0.63	x	0.7	=	31.78	(74)
North	0.9x	0.77	x	3.2	x	74.68	x	0.63	x	0.7	=	73.03	(74)
North	0.9x	0.77	x	1.9	x	74.68	x	0.63	x	0.7	=	43.36	(74)
North	0.9x	0.77	x	4.3	x	74.68	x	0.63	x	0.7	=	98.14	(74)
North	0.9x	0.77	x	4	x	74.68	x	0.63	x	0.7	=	91.29	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.63	x	0.7	=	75.31	(74)
North	0.9x	0.77	x	3.3	x	74.68	x	0.63	x	0.7	=	75.31	(74)
North	0.9x	0.77	x	1.3	x	74.68	x	0.63	x	0.7	=	29.67	(74)
North	0.9x	0.77	x	3.2	x	59.25	x	0.63	x	0.7	=	57.94	(74)
North	0.9x	0.77	x	1.9	x	59.25	x	0.63	x	0.7	=	34.4	(74)
North	0.9x	0.77	x	4.3	x	59.25	x	0.63	x	0.7	=	77.86	(74)
North	0.9x	0.77	x	4	x	59.25	x	0.63	x	0.7	=	72.43	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.63	x	0.7	=	59.75	(74)
North	0.9x	0.77	x	3.3	x	59.25	x	0.63	x	0.7	=	59.75	(74)
North	0.9x	0.77	x	1.3	x	59.25	x	0.63	x	0.7	=	23.54	(74)
North	0.9x	0.77	x	3.2	x	41.52	x	0.63	x	0.7	=	40.6	(74)
North	0.9x	0.77	x	1.9	x	41.52	x	0.63	x	0.7	=	24.11	(74)
North	0.9x	0.77	x	4.3	x	41.52	x	0.63	x	0.7	=	54.56	(74)
North	0.9x	0.77	x	4	x	41.52	x	0.63	x	0.7	=	50.75	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.63	x	0.7	=	41.87	(74)
North	0.9x	0.77	x	3.3	x	41.52	x	0.63	x	0.7	=	41.87	(74)
North	0.9x	0.77	x	1.3	x	41.52	x	0.63	x	0.7	=	16.49	(74)
North	0.9x	0.77	x	3.2	x	24.19	x	0.63	x	0.7	=	23.66	(74)
North	0.9x	0.77	x	1.9	x	24.19	x	0.63	x	0.7	=	14.05	(74)
North	0.9x	0.77	x	4.3	x	24.19	x	0.63	x	0.7	=	31.79	(74)
North	0.9x	0.77	x	4	x	24.19	x	0.63	x	0.7	=	29.57	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.63	x	0.7	=	24.4	(74)
North	0.9x	0.77	x	3.3	x	24.19	x	0.63	x	0.7	=	24.4	(74)
North	0.9x	0.77	x	1.3	x	24.19	x	0.63	x	0.7	=	9.61	(74)
North	0.9x	0.77	x	3.2	x	13.12	x	0.63	x	0.7	=	12.83	(74)
North	0.9x	0.77	x	1.9	x	13.12	x	0.63	x	0.7	=	7.62	(74)
North	0.9x	0.77	x	4.3	x	13.12	x	0.63	x	0.7	=	17.24	(74)
North	0.9x	0.77	x	4	x	13.12	x	0.63	x	0.7	=	16.04	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.63	x	0.7	=	13.23	(74)
North	0.9x	0.77	x	3.3	x	13.12	x	0.63	x	0.7	=	13.23	(74)
North	0.9x	0.77	x	1.3	x	13.12	x	0.63	x	0.7	=	5.21	(74)
North	0.9x	0.77	x	3.2	x	8.86	x	0.63	x	0.7	=	8.67	(74)
North	0.9x	0.77	x	1.9	x	8.86	x	0.63	x	0.7	=	5.15	(74)
North	0.9x	0.77	x	4.3	x	8.86	x	0.63	x	0.7	=	11.65	(74)

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North	0.9x	0.77	x	4	x	8.86	x	0.63	x	0.7	=	10.84	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	3.3	x	8.86	x	0.63	x	0.7	=	8.94	(74)
North	0.9x	0.77	x	1.3	x	8.86	x	0.63	x	0.7	=	3.52	(74)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	69.22	132.28	224.78	361.05	486.37	520.67	486.11	385.67	270.25	157.46	85.39	57.7	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	577.22	638.04	713.81	822.84	920	927.51	875.75	781.84	680.59	595.28	554.84	551.34	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	1	0.99	0.94	0.81	0.64	0.73	0.94	0.99	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.67	19.78	20.01	20.36	20.69	20.91	20.98	20.96	20.77	20.37	19.97	19.65	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	19.99	20	20	20.01	20	19.99	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	1	1	0.98	0.91	0.72	0.51	0.6	0.9	0.99	1	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.18	18.35	18.69	19.2	19.67	19.94	20	19.99	19.79	19.22	18.63	18.17	(90)

fLA = Living area ÷ (4) = 0.4 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.78	18.93	19.22	19.66	20.08	20.33	20.39	20.38	20.19	19.68	19.17	18.76	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.78	18.93	19.22	19.66	20.08	20.33	20.39	20.38	20.19	19.68	19.17	18.76	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	1	1	0.99	0.98	0.91	0.75	0.57	0.65	0.91	0.99	1	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	576.5	636.56	709.52	803.96	839.67	697.69	496.11	508.14	616.75	588.1	553.49	550.8	(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=	2002	1934.45	1750.13	1463.58	1136.95	769.67	509.09	533.4	820.53	1231.98	1644.52	1993.95	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	1060.58	872.18	774.21	474.93	221.18	0	0	0	0	479.05	785.54	1073.71	

Total per year (kWh/year) = Sum(98)$_{1…5,9…12}$ = 5741.36 (98)

Space heating requirement in kWh/m²/year 46.87 (99)

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9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)	1060.58	872.18	774.21	474.93	221.18	0	0	0	0	479.05	785.54	1073.71		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	1134.31	932.81	828.03	507.94	236.55	0	0	0	0	512.35	840.15	1148.35		(211)
Total (kWh/year) =Sum(211)$_{1...5,10....12}$=													6140.5	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10....12}$=													0	(215)

Water heating

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Output from water heater (calculated above)	213.67	188.21	197.38	176.55	172.74	153.94	147.46	162.34	162.22	183.09	194.09	208.4		
Efficiency of water heater													79.8	(216)
(217)m=	88.51	88.4	88.1	87.33	85.47	79.8	79.8	79.8	79.8	87.26	88.16	88.57		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	241.41	212.92	224.05	202.18	202.09	192.91	184.79	203.43	203.28	209.82	220.16	235.29		
Total = Sum(219a)$_{1...12}$ =													2532.33	(219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			6140.5	
Water heating fuel used			2532.33	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			454.09	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	1326.35	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	546.98	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1873.33	(265)

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Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	235.67	(268)
Total CO2, kg/year		sum of (265)…(271) =		2147.93	(272)

TER = 25.94 (273)

DRAFT

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: A08_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39	(1a) x	2.8	(2a) =	109.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	109.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			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			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.3		x1/[1/(1.3)+ 0.04]	=	1.61			(27)
Windows Type 2			2.5		x1/[1/(1.3)+ 0.04]	=	3.09			(27)
Windows Type 3			4.1		x1/[1/(1.3)+ 0.04]	=	5.07			(27)
Walls	31.92	12.9	19.02	x	0.15	=	2.85			(29)
Total area of elements, m²			31.92							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 18.37 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.6 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 19.97 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	10.09	9.98	9.86	9.29	9.17	8.6	8.6	8.48	8.83	9.17	9.4	9.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	30.06	29.94	29.83	29.25	29.14	28.56	28.56	28.45	28.79	29.14	29.37	29.6	

Average = Sum(39)$_{1…12}$ /12= 29.22 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.77	0.77	0.76	0.75	0.75	0.73	0.73	0.73	0.74	0.75	0.75	0.76

Average = Sum(40)$_{1…12}$ /12= 0.75 (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 1.38 (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 66.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.67	70.99	68.31	65.64	62.96	60.28	60.28	62.96	65.64	68.31	70.99	73.67	
										Total = Sum(44)$_{1…12}$ =		803.71	(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=	109.25	95.56	98.6	85.97	82.49	71.18	65.96	75.69	76.59	89.26	97.43	105.81	
										Total = Sum(45)$_{1…12}$ =		1053.78	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	16.39	14.33	14.79	12.89	12.37	10.68	9.89	11.35	11.49	13.39	14.62	15.87	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)
If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H													
(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	162.84	143.95	152.18	137.82	136.07	123.03	119.54	129.27	128.44	142.84	149.29	159.39	(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=	162.84	143.95	152.18	137.82	136.07	123.03	119.54	129.27	128.44	142.84	149.29	159.39	

Output from water heater (annual)$_{1...12}$ 1684.65 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.19	70.49	75.65	70.07	70.29	65.15	64.8	68.03	66.95	72.54	73.88	78.05	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69	69	69	69	69	69	69	69	69	69	69	69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.62	9.44	7.67	5.81	4.34	3.67	3.96	5.15	6.91	8.78	10.24	10.92	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.03	120.26	117.15	110.52	102.16	94.3	89.05	87.81	90.92	97.55	105.91	113.78	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	(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=	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	(71)

Water heating gains (Table 5)

(72)m=	106.44	104.89	101.68	97.31	94.48	90.48	87.09	91.44	92.98	97.5	102.61	104.9	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	279.79	278.29	270.2	257.35	244.68	232.15	223.8	228.1	234.52	247.53	262.47	273.29	(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)	
East	0.9x	0.3	x	2.5	x	19.64	x	0.53	x	0.82	=	5.76	(76)
East	0.9x	0.3	x	4.1	x	19.64	x	0.53	x	0.7	=	8.07	(76)
East	0.9x	0.3	x	2.5	x	38.42	x	0.53	x	0.82	=	11.27	(76)
East	0.9x	0.3	x	4.1	x	38.42	x	0.53	x	0.7	=	15.78	(76)
East	0.9x	0.3	x	2.5	x	63.27	x	0.53	x	0.82	=	18.56	(76)

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East	0.9x	0.3	x	4.1	x	63.27	x	0.53	x	0.7	=	25.99	(76)
East	0.9x	0.3	x	2.5	x	92.28	x	0.53	x	0.82	=	27.07	(76)
East	0.9x	0.3	x	4.1	x	92.28	x	0.53	x	0.7	=	37.9	(76)
East	0.9x	0.3	x	2.5	x	113.09	x	0.53	x	0.82	=	33.18	(76)
East	0.9x	0.3	x	4.1	x	113.09	x	0.53	x	0.7	=	46.45	(76)
East	0.9x	0.3	x	2.5	x	115.77	x	0.53	x	0.82	=	33.96	(76)
East	0.9x	0.3	x	4.1	x	115.77	x	0.53	x	0.7	=	47.55	(76)
East	0.9x	0.3	x	2.5	x	110.22	x	0.53	x	0.82	=	32.33	(76)
East	0.9x	0.3	x	4.1	x	110.22	x	0.53	x	0.7	=	45.27	(76)
East	0.9x	0.3	x	2.5	x	94.68	x	0.53	x	0.82	=	27.77	(76)
East	0.9x	0.3	x	4.1	x	94.68	x	0.53	x	0.7	=	38.88	(76)
East	0.9x	0.3	x	2.5	x	73.59	x	0.53	x	0.82	=	21.59	(76)
East	0.9x	0.3	x	4.1	x	73.59	x	0.53	x	0.7	=	30.22	(76)
East	0.9x	0.3	x	2.5	x	45.59	x	0.53	x	0.82	=	13.37	(76)
East	0.9x	0.3	x	4.1	x	45.59	x	0.53	x	0.7	=	18.72	(76)
East	0.9x	0.3	x	2.5	x	24.49	x	0.53	x	0.82	=	7.18	(76)
East	0.9x	0.3	x	4.1	x	24.49	x	0.53	x	0.7	=	10.06	(76)
East	0.9x	0.3	x	2.5	x	16.15	x	0.53	x	0.82	=	4.74	(76)
East	0.9x	0.3	x	4.1	x	16.15	x	0.53	x	0.7	=	6.63	(76)
West	0.9x	0.77	x	1.3	x	19.64	x	0.53	x	0.7	=	6.56	(80)
West	0.9x	0.77	x	1.3	x	38.42	x	0.53	x	0.7	=	12.84	(80)
West	0.9x	0.77	x	1.3	x	63.27	x	0.53	x	0.7	=	21.15	(80)
West	0.9x	0.77	x	1.3	x	92.28	x	0.53	x	0.7	=	30.84	(80)
West	0.9x	0.77	x	1.3	x	113.09	x	0.53	x	0.7	=	37.8	(80)
West	0.9x	0.77	x	1.3	x	115.77	x	0.53	x	0.7	=	38.69	(80)
West	0.9x	0.77	x	1.3	x	110.22	x	0.53	x	0.7	=	36.84	(80)
West	0.9x	0.77	x	1.3	x	94.68	x	0.53	x	0.7	=	31.64	(80)
West	0.9x	0.77	x	1.3	x	73.59	x	0.53	x	0.7	=	24.6	(80)
West	0.9x	0.77	x	1.3	x	45.59	x	0.53	x	0.7	=	15.24	(80)
West	0.9x	0.77	x	1.3	x	24.49	x	0.53	x	0.7	=	8.19	(80)
West	0.9x	0.77	x	1.3	x	16.15	x	0.53	x	0.7	=	5.4	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	20.39	39.89	65.7	95.81	117.42	120.2	114.44	98.3	76.41	47.33	25.43	16.77	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	300.18	318.18	335.9	353.16	362.1	352.35	338.24	326.4	310.93	294.87	287.89	290.06	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.88	0.72	0.52	0.37	0.4	0.63	0.89	0.97	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.47	20.56	20.71	20.89	20.98	21	21	21	20.99	20.89	20.67	20.46	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.28	20.28	20.3	20.3	20.31	20.31	20.31	20.31	20.3	20.29	20.29	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.85	0.68	0.46	0.31	0.34	0.57	0.86	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.58	19.71	19.93	20.17	20.28	20.31	20.31	20.31	20.3	20.19	19.88	19.57	(90)

fLA = Living area ÷ (4) = 0.54 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	20.06	20.17	20.35	20.55	20.65	20.68	20.68	20.68	20.67	20.57	20.3	20.04	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	20.06	20.17	20.35	20.55	20.65	20.68	20.68	20.68	20.67	20.57	20.3	20.04	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.98	0.97	0.95	0.86	0.7	0.49	0.34	0.37	0.6	0.87	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	295.56	310.17	317.9	304.3	253.46	173.15	116.53	121.76	187.2	256.88	278.21	286.34	(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=	473.61	457.13	413.08	340.95	260.84	173.65	116.56	121.82	189.24	290.4	387.72	468.97	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	132.47	98.75	70.81	26.39	5.5	0	0	0	0	24.94	78.85	135.88	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 573.57 (98)

Space heating requirement in kWh/m²/year 14.71 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.25 (306)

Space heating		**kWh/year**	
Annual space heating requirement		573.57	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	716.96	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1684.65	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2105.81	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	28.23	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		101.58	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	101.58	(331)
Energy for lighting (calculated in Appendix L)		187.63	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-255.24	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	459.25	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	14.65	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	473.9	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				473.9	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	52.72	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	97.38	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-132.47	(380)
Total CO2, kg/year	sum of (376)…(382) =				491.54	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.6	(384)
EI rating (section 14)					92.16	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: A08_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39	(1a) x	2.8	(2a) =	109.2	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		109.2	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.18	(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)	0.43	(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) =	0.37	(21)

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7

Wind Factor (22a)m = (22)m ÷ 4

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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

0.47	0.46	0.45	0.4	0.4	0.35	0.35	0.34	0.37	0.4	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Windows Type 2			1.5	x1/[1/(1.4)+ 0.04]		=	1.99			(27)
Windows Type 3			2.47	x1/[1/(1.4)+ 0.04]		=	3.27			(27)
Walls	31.92	9.75	22.17	x	0.18	=	3.99			(29)
Total area of elements, m²			31.92							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 16.29 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 1.6 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 17.89 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	21.99	21.83	21.68	20.97	20.84	20.22	20.22	20.11	20.46	20.84	21.11	21.39	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	39.88	39.72	39.57	38.86	38.73	38.11	38.11	38	38.35	38.73	39	39.28	

Average = Sum(39)$_{1…12}$ /12= 38.86 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.02	1.02	1.01	1	0.99	0.98	0.98	0.97	0.98	0.99	1	1.01

Average = Sum(40)$_{1…12}$ /12= 1 (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 1.38 (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 66.98 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	73.67	70.99	68.31	65.64	62.96	60.28	60.28	62.96	65.64	68.31	70.99	73.67

Total = Sum(44)$_{1…12}$ = 803.71 (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=	109.25	95.56	98.6	85.97	82.49	71.18	65.96	75.69	76.59	89.26	97.43	105.81

Total = Sum(45)$_{1…12}$ = 1053.78 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	16.39	14.33	14.79	12.89	12.37	10.68	9.89	11.35	11.49	13.39	14.62	15.87	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4	(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=	155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4	

Output from water heater (annual)$_{1...12}$ 1602.4 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.6	65.44	70.06	64.66	64.7	59.74	59.21	62.44	61.54	66.95	68.47	72.46	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69	69	69	69	69	69	69	69	69	69	69	69	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	11.15	9.9	8.05	6.1	4.56	3.85	4.16	5.4	7.25	9.21	10.75	11.46	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.03	120.26	117.15	110.52	102.16	94.3	89.05	87.81	90.92	97.55	105.91	113.78	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	-55.2	(71)

Water heating gains (Table 5)

(72)m=	98.93	97.38	94.17	89.8	86.97	82.97	79.58	83.93	85.47	89.99	95.1	97.39	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	275.8	274.24	266.07	253.12	240.38	227.82	219.48	223.84	230.35	243.45	258.46	269.32	(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)	
East	0.9x	0.3	x	1.5	x	19.64	x	0.63	x	0.7	=	3.51	(76)
East	0.9x	0.3	x	2.47	x	19.64	x	0.63	x	0.7	=	5.78	(76)
East	0.9x	0.3	x	1.5	x	38.42	x	0.63	x	0.7	=	6.86	(76)
East	0.9x	0.3	x	2.47	x	38.42	x	0.63	x	0.7	=	11.3	(76)
East	0.9x	0.3	x	1.5	x	63.27	x	0.63	x	0.7	=	11.3	(76)

East	0.9x	0.3	x	2.47	x	63.27	x	0.63	x	0.7	=	18.61	(76)
East	0.9x	0.3	x	1.5	x	92.28	x	0.63	x	0.7	=	16.48	(76)
East	0.9x	0.3	x	2.47	x	92.28	x	0.63	x	0.7	=	27.14	(76)
East	0.9x	0.3	x	1.5	x	113.09	x	0.63	x	0.7	=	20.2	(76)
East	0.9x	0.3	x	2.47	x	113.09	x	0.63	x	0.7	=	33.26	(76)
East	0.9x	0.3	x	1.5	x	115.77	x	0.63	x	0.7	=	20.68	(76)
East	0.9x	0.3	x	2.47	x	115.77	x	0.63	x	0.7	=	34.05	(76)
East	0.9x	0.3	x	1.5	x	110.22	x	0.63	x	0.7	=	19.69	(76)
East	0.9x	0.3	x	2.47	x	110.22	x	0.63	x	0.7	=	32.42	(76)
East	0.9x	0.3	x	1.5	x	94.68	x	0.63	x	0.7	=	16.91	(76)
East	0.9x	0.3	x	2.47	x	94.68	x	0.63	x	0.7	=	27.84	(76)
East	0.9x	0.3	x	1.5	x	73.59	x	0.63	x	0.7	=	13.14	(76)
East	0.9x	0.3	x	2.47	x	73.59	x	0.63	x	0.7	=	21.64	(76)
East	0.9x	0.3	x	1.5	x	45.59	x	0.63	x	0.7	=	8.14	(76)
East	0.9x	0.3	x	2.47	x	45.59	x	0.63	x	0.7	=	13.41	(76)
East	0.9x	0.3	x	1.5	x	24.49	x	0.63	x	0.7	=	4.37	(76)
East	0.9x	0.3	x	2.47	x	24.49	x	0.63	x	0.7	=	7.2	(76)
East	0.9x	0.3	x	1.5	x	16.15	x	0.63	x	0.7	=	2.88	(76)
East	0.9x	0.3	x	2.47	x	16.15	x	0.63	x	0.7	=	4.75	(76)
West	0.9x	0.77	x	0.78	x	19.64	x	0.63	x	0.7	=	4.68	(80)
West	0.9x	0.77	x	0.78	x	38.42	x	0.63	x	0.7	=	9.16	(80)
West	0.9x	0.77	x	0.78	x	63.27	x	0.63	x	0.7	=	15.08	(80)
West	0.9x	0.77	x	0.78	x	92.28	x	0.63	x	0.7	=	22	(80)
West	0.9x	0.77	x	0.78	x	113.09	x	0.63	x	0.7	=	26.96	(80)
West	0.9x	0.77	x	0.78	x	115.77	x	0.63	x	0.7	=	27.6	(80)
West	0.9x	0.77	x	0.78	x	110.22	x	0.63	x	0.7	=	26.27	(80)
West	0.9x	0.77	x	0.78	x	94.68	x	0.63	x	0.7	=	22.57	(80)
West	0.9x	0.77	x	0.78	x	73.59	x	0.63	x	0.7	=	17.54	(80)
West	0.9x	0.77	x	0.78	x	45.59	x	0.63	x	0.7	=	10.87	(80)
West	0.9x	0.77	x	0.78	x	24.49	x	0.63	x	0.7	=	5.84	(80)
West	0.9x	0.77	x	0.78	x	16.15	x	0.63	x	0.7	=	3.85	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	13.97	27.32	44.99	65.62	80.42	82.32	78.37	67.32	52.33	32.42	17.41	11.48	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	289.77	301.56	311.06	318.74	320.8	310.14	297.86	291.16	282.68	275.87	275.87	280.8	(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=	0.99	0.99	0.98	0.96	0.89	0.73	0.55	0.59	0.82	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.07	20.16	20.34	20.59	20.82	20.96	20.99	20.99	20.92	20.66	20.33	20.06	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.07	20.07	20.09	20.09	20.1	20.1	20.1	20.1	20.09	20.08	20.08	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.86	0.65	0.45	0.48	0.75	0.94	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.83	18.97	19.23	19.6	19.91	20.07	20.1	20.1	20.03	19.7	19.23	18.83	(90)

fLA = Living area ÷ (4) = 0.54 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.5	19.61	19.82	20.13	20.39	20.55	20.58	20.58	20.51	20.21	19.82	19.49	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.5	19.61	19.82	20.13	20.39	20.55	20.58	20.58	20.51	20.21	19.82	19.49	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.69	0.5	0.54	0.79	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	287.19	297.79	304.07	302.13	279	215.21	150.06	156.49	222.04	260.72	271.28	278.67	(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=	605.93	584.2	527.28	436.59	336.74	226.7	151.62	158.73	245.74	372.29	496.14	600.51	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	237.15	192.47	166.07	96.82	42.96	0	0	0	0	83	161.9	239.45	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1219.81 (98)

Space heating requirement in kWh/m²/year 31.28 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	237.15	192.47	166.07	96.82	42.96	0	0	0	0	83	161.9	239.45	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	253.63	205.85	177.61	103.55	45.94	0	0	0	0	88.77	173.16	256.09	

Total (kWh/year) =$Sum(211)_{1...5,10....12}$= 1304.61 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =$Sum(215)_{1...5,10....12}$= 0 (215)

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Water heating

Output from water heater (calculated above)

	155.85	137.64	145.2	131.06	129.08	116.27	112.55	122.28	121.68	135.86	142.53	152.4	
Efficiency of water heater													79.8 (216)
(217)m=	85.93	85.71	85.17	84.02	82.23	79.8	79.8	79.8	79.8	83.55	85.15	86.01	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	181.37	160.59	170.48	155.98	156.98	145.7	141.04	153.24	152.49	162.61	167.37	177.18

Total = Sum(219a)$_{1...12}$ = 1925.03 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1304.61	
Water heating fuel used		1925.03	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		196.84	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	281.8	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	415.81	(264)
Space and water heating	(261) + (262) + (263) + (264) =				697.6	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	102.16	(268)
Total CO2, kg/year			sum of (265)…(271) =		838.69	(272)

TER = 31.34 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: B44_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	75.7	(1a)	x	2.8	(2a)	=	211.96	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.7	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	211.96	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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 *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*		0	(11)
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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

DRAFT

DER WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.5	x 1.3 =	3.25			(26)
Windows Type 1			2.4	x1/[1/(1.3)+ 0.04] =	2.97			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04] =	3.21			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04] =	3.21			(27)
Windows Type 4			2.6	x1/[1/(1.3)+ 0.04] =	3.21			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04] =	3.21			(27)
Walls Type1	45.92	23.1	22.82	x 0.15 =	3.42			(29)
Walls Type2	20.16	0	20.16	x 0.14 =	2.85			(29)
Total area of elements, m²			66.08					(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.98 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.3 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 38.29 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.59	19.37	19.14	18.03	17.81	16.69	16.69	16.47	17.14	17.81	18.25	18.7	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	57.88	57.65	57.43	56.32	56.09	54.98	54.98	54.76	55.42	56.09	56.54	56.98	

Average = Sum(39)$_{1…12}$ /12= 56.26 (39)

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Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

(40)m=	0.76	0.76	0.76	0.74	0.74	0.73	0.73	0.72	0.73	0.74	0.75	0.75

Average = Sum(40)$_{1…12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.38 (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 — 90.64 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)												
(44)m=	99.7	96.07	92.45	88.82	85.2	81.57	81.57	85.2	88.82	92.45	96.07	99.7

Total = Sum(44)$_{1…12}$ = 1087.62 (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=	147.85	129.31	133.44	116.33	111.62	96.32	89.26	102.43	103.65	120.79	131.85	143.18

Total = Sum(45)$_{1…12}$ = 1426.04 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.18	19.4	20.02	17.45	16.74	14.45	13.39	15.36	15.55	18.12	19.78	21.48	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 150 (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): — 1.63 (48)

Temperature factor from Table 2b — 0.6 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 0.98 (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) — 0.98 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	201.43	177.71	187.02	168.19	165.21	148.18	142.84	156.01	155.5	174.37	183.71	196.77	(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=	201.43	177.71	187.02	168.19	165.21	148.18	142.84	156.01	155.5	174.37	183.71	196.77	

Output from water heater (annual)$_{1...12}$ 2056.91 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	92.02	81.71	87.23	80.16	79.98	73.51	72.54	76.92	75.94	83.03	85.32	90.47	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.74	16.65	13.54	10.25	7.66	6.47	6.99	9.08	12.19	15.48	18.07	19.26	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	210.22	212.4	206.9	195.2	180.43	166.54	157.27	155.09	160.58	172.29	187.06	200.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	(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=	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	(71)

Water heating gains (Table 5)

(72)m=	123.69	121.6	117.25	111.34	107.5	102.1	97.5	103.39	105.48	111.6	118.5	121.6	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	411.29	409.29	396.33	375.43	354.23	333.75	320.4	326.2	336.9	358.01	382.28	400.45	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
Northeast 0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast 0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast 0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast 0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast 0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)

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Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)
Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)

East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	84.42	165.6	274.5	404.15	499.34	513.11	487.69	416.1	320.41	196.91	105.33	69.39	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	495.72	574.89	670.83	779.58	853.58	846.86	808.1	742.3	657.3	554.92	487.61	469.85	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.95	0.81	0.6	0.42	0.3	0.34	0.58	0.9	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.37	20.52	20.74	20.94	20.99	21	21	21	21	20.89	20.59	20.35	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.28	20.29	20.29	20.3	20.3	20.32	20.32	20.32	20.31	20.3	20.3	20.29	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.78	0.56	0.37	0.25	0.29	0.52	0.87	0.98	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.44	19.66	19.97	20.23	20.3	20.32	20.32	20.32	20.31	20.18	19.78	19.41	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.79	19.98	20.26	20.5	20.56	20.57	20.57	20.58	20.57	20.45	20.08	19.77	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.79	19.98	20.26	20.5	20.56	20.57	20.57	20.58	20.57	20.45	20.08	19.77	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.94	0.79	0.58	0.39	0.27	0.31	0.54	0.88	0.98	0.99	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	492.3	564.09	627.72	614.65	492.79	328.27	218.5	228.64	356.55	486.54	478.68	467.48	(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=	896.47	869.5	790.16	653.13	496.95	328.45	218.51	228.67	358.48	552.44	734.08	886.98	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	300.7	205.23	120.86	27.71	3.1	0	0	0	0	49.03	183.88	312.11	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1202.62 (98)

Space heating requirement in kWh/m²/year 15.89 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1202.62	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1503.27	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2056.91	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2571.14	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	40.74	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		197.18	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	197.18	(331)
Energy for lighting (calculated in Appendix L)		330.98	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-494.01	(333)

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Electricity generated by wind turbine (Appendix M) (negative quantity)				0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	= 662.89	(367)
Electrical energy for heat distribution	[(313) x		0.52	= 21.15	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			= 684.04	(373)
CO2 associated with space heating (secondary)	(309) x		0	= 0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	= 0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			684.04	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	= 102.33	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	= 171.78	(379)
Energy saving/generation technologies (333) to (334) as applicable					
Item 1		0.52	x 0.01 =	-256.39	(380)
Total CO2, kg/year	sum of (376)…(382) =			701.76	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.27	(384)
EI rating (section 14)				92.21	(385)

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User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: B44_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.7	(1a) x	2.8	(2a) =	211.96	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.7	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.96	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(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

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.5	x	1.2	=	3			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 3			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 4			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Windows Type 5			2.07	x1/[1/(1.4)+ 0.04]		=	2.74			(27)
Walls Type1	45.92	18.9	27.02	x	0.18	=	4.86			(29)
Walls Type2	20.16	0	20.16	x	0.18	=	3.63			(29)
Total area of elements, m²			66.08							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.23 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.3 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 36.54 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.27	41.03	40.79	39.66	39.45	38.47	38.47	38.29	38.85	39.45	39.88	40.32	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.81	77.57	77.33	76.2	75.99	75.01	75.01	74.83	75.39	75.99	76.42	76.86	

Average = $Sum(39)_{1…12}$ /12= 76.2 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.02	1.02	1.01	1	0.99	0.99	0.99	1	1	1.01	1.02

Average = Sum(40)$_{1…12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.38 (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 90.64 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	99.7	96.07	92.45	88.82	85.2	81.57	81.57	85.2	88.82	92.45	96.07	99.7	
											Total = Sum(44)$_{1…12}$ =	1087.62	(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=	147.85	129.31	133.44	116.33	111.62	96.32	89.26	102.43	103.65	120.79	131.85	143.18	
											Total = Sum(45)$_{1…12}$ =	1426.04	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	22.18	19.4	20.02	17.45	16.74	14.45	13.39	15.36	15.55	18.12	19.78	21.48	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78	(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=	194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78	

Output from water heater (annual)$_{1...12}$ 1974.66 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.44	76.66	81.64	74.75	74.39	68.1	66.95	71.33	70.54	77.44	79.91	84.88	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	118.81	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.75	16.66	13.55	10.25	7.67	6.47	6.99	9.09	12.2	15.49	18.08	19.27	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	210.22	212.4	206.9	195.2	180.43	166.54	157.27	155.09	160.58	172.29	187.06	200.94	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	34.88	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	-95.05	(71)

Water heating gains (Table 5)

(72)m=	116.18	114.08	109.74	103.83	99.99	94.58	89.99	95.88	97.97	104.09	110.99	114.09	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.79	404.78	391.83	370.92	349.73	329.24	315.9	321.7	332.4	353.51	377.78	395.95	(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)	
Northeast 0.9x	0.3	x	1.91	x	11.28	x	0.63	x	0.7	=	2.57	(75)
Northeast 0.9x	0.3	x	2.07	x	11.28	x	0.63	x	0.7	=	2.78	(75)
Northeast 0.9x	0.3	x	1.91	x	22.97	x	0.63	x	0.7	=	5.22	(75)
Northeast 0.9x	0.3	x	2.07	x	22.97	x	0.63	x	0.7	=	5.66	(75)
Northeast 0.9x	0.3	x	1.91	x	41.38	x	0.63	x	0.7	=	9.41	(75)

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Northeast	0.9x	0.3	x	2.07	x	41.38	x	0.63	x	0.7	=	10.2	(75)
Northeast	0.9x	0.3	x	1.91	x	67.96	x	0.63	x	0.7	=	15.45	(75)
Northeast	0.9x	0.3	x	2.07	x	67.96	x	0.63	x	0.7	=	16.75	(75)
Northeast	0.9x	0.3	x	1.91	x	91.35	x	0.63	x	0.7	=	20.77	(75)
Northeast	0.9x	0.3	x	2.07	x	91.35	x	0.63	x	0.7	=	22.51	(75)
Northeast	0.9x	0.3	x	1.91	x	97.38	x	0.63	x	0.7	=	22.15	(75)
Northeast	0.9x	0.3	x	2.07	x	97.38	x	0.63	x	0.7	=	24	(75)
Northeast	0.9x	0.3	x	1.91	x	91.1	x	0.63	x	0.7	=	20.72	(75)
Northeast	0.9x	0.3	x	2.07	x	91.1	x	0.63	x	0.7	=	22.45	(75)
Northeast	0.9x	0.3	x	1.91	x	72.63	x	0.63	x	0.7	=	16.52	(75)
Northeast	0.9x	0.3	x	2.07	x	72.63	x	0.63	x	0.7	=	17.9	(75)
Northeast	0.9x	0.3	x	1.91	x	50.42	x	0.63	x	0.7	=	11.47	(75)
Northeast	0.9x	0.3	x	2.07	x	50.42	x	0.63	x	0.7	=	12.43	(75)
Northeast	0.9x	0.3	x	1.91	x	28.07	x	0.63	x	0.7	=	6.38	(75)
Northeast	0.9x	0.3	x	2.07	x	28.07	x	0.63	x	0.7	=	6.92	(75)
Northeast	0.9x	0.3	x	1.91	x	14.2	x	0.63	x	0.7	=	3.23	(75)
Northeast	0.9x	0.3	x	2.07	x	14.2	x	0.63	x	0.7	=	3.5	(75)
Northeast	0.9x	0.3	x	1.91	x	9.21	x	0.63	x	0.7	=	2.1	(75)
Northeast	0.9x	0.3	x	2.07	x	9.21	x	0.63	x	0.7	=	2.27	(75)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	19.64	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	38.42	x	0.63	x	0.7	=	48.61	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	63.27	x	0.63	x	0.7	=	80.06	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	92.28	x	0.63	x	0.7	=	116.76	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	113.09	x	0.63	x	0.7	=	143.09	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	115.77	x	0.63	x	0.7	=	146.48	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	110.22	x	0.63	x	0.7	=	139.45	(76)
East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)

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East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)
East	0.9x	0.77	x	2.07	x	94.68	x	0.63	x	0.7	=	119.79	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	73.59	x	0.63	x	0.7	=	93.11	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	45.59	x	0.63	x	0.7	=	57.68	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	24.49	x	0.63	x	0.7	=	30.98	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)
East	0.9x	0.77	x	2.07	x	16.15	x	0.63	x	0.7	=	20.44	(76)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	79.9	156.72	259.78	382.47	472.56	485.58	461.53	393.78	303.22	186.34	99.68	65.67	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	486.69	561.5	651.6	753.4	822.28	814.83	777.43	715.48	635.61	539.85	477.46	461.63	(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=	1	0.99	0.98	0.92	0.78	0.58	0.42	0.48	0.75	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.97	20.12	20.39	20.71	20.91	20.99	21	21	20.95	20.65	20.25	19.94	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.72	0.5	0.34	0.39	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.68	18.91	19.29	19.75	20	20.08	20.09	20.09	20.05	19.68	19.11	18.66	(90)

fLA = Living area ÷ (4) = | 0.38 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.17	19.37	19.7	20.11	20.35	20.42	20.43	20.43	20.39	20.05	19.54	19.14	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.17	19.37	19.7	20.11	20.35	20.42	20.43	20.43	20.39	20.05	19.54	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=	1	0.99	0.97	0.9	0.74	0.53	0.37	0.42	0.7	0.94	0.99	1	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	484.28	555.29	630.85	675.25	608.5	430.81	286.8	300.43	447.14	507.99	472.33	459.88	(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=	1156.72	1122.14	1020.98	854.13	656.96	436.8	287.44	301.72	473.89	718.03	950.55	1148.36	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	500.3	380.92	290.26	128.79	36.06	0	0	0	0	156.27	344.32	512.22

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2349.14 (98)

Space heating requirement in kWh/m²/year 31.03 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)	500.3	380.92	290.26	128.79	36.06	0	0	0	0	156.27	344.32	512.22	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)	535.08	407.41	310.44	137.74	38.57	0	0	0	0	167.13	368.26	547.83	(211)

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2512.45 (211)

Space heating fuel (secondary), kWh/month
= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

194.45	171.4	180.03	161.43	158.22	141.42	135.85	149.02	148.74	167.39	176.95	189.78

Efficiency of water heater 79.8 (216)

(217)m=	87.23	86.88	86.08	84.22	81.59	79.8	79.8	79.8	79.8	84.63	86.56	87.33	(217)

Fuel for water heating, kWh/month
(219)m = (64)m x 100 ÷ (217)m

(219)m=	222.92	197.27	209.14	191.67	193.92	177.21	170.24	186.74	186.39	197.78	204.42	217.3

Total = Sum(219a)$_{1...12}$ = 2355.02 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		2512.45	
Water heating fuel used		2355.02	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			331.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	542.69	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	508.68	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1051.37	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	171.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1262.18	(272)

TER = 24.31 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: C85_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.4	(1a) x	2.8	(2a) =	205.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.4	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	205.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.9	x1/[1/(1.3)+ 0.04]		=	2.35			(27)
Windows Type 2			4.1	x1/[1/(1.3)+ 0.04]		=	5.07			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			5.1	x1/[1/(1.3)+ 0.04]		=	6.3			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls	83.16	26.5	56.66	x	0.15	=	8.5			(29)
Total area of elements, m²			83.16							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.82 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 44.98 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	18.99	18.78	18.56	17.48	17.26	16.18	16.18	15.97	16.62	17.26	17.7	18.13	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	63.97	63.76	63.54	62.46	62.24	61.16	61.16	60.95	61.59	62.24	62.67	63.11	

Average = Sum(39)$_{1…12}$ /12= 62.4 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.87	0.87	0.87	0.85	0.85	0.83	0.83	0.83	0.84	0.85	0.85	0.86

Average = Sum(40)$_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (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 89.44 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	98.38	94.8	91.23	87.65	84.07	80.49	80.49	84.07	87.65	91.23	94.8	98.38	
										Total = Sum(44)$_{1…12}$ =		1073.24	(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=	145.9	127.6	131.67	114.8	110.15	95.05	88.08	101.07	102.28	119.2	130.11	141.29	
										Total = Sum(45)$_{1…12}$ =		1407.19	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	199.48	176	185.25	166.65	163.73	146.9	141.66	154.65	154.13	172.78	181.96	194.87	(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=	199.48	176	185.25	166.65	163.73	146.9	141.66	154.65	154.13	172.78	181.96	194.87	

Output from water heater (annual)$_{1...12}$ 2038.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.37	81.14	86.65	79.65	79.49	73.09	72.15	76.47	75.49	82.5	84.74	89.84	(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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.28	16.24	13.21	10	7.47	6.31	6.82	8.86	11.9	15.1	17.63	18.79	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	205.1	207.23	201.86	190.45	176.03	162.49	153.44	151.31	156.67	168.09	182.5	196.05	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(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=	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	(71)

Water heating gains (Table 5)

(72)m=	122.82	120.75	116.46	110.63	106.84	101.51	96.98	102.78	104.85	110.88	117.7	120.76	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	404.09	402.1	389.42	368.96	348.23	328.19	315.12	320.84	331.3	351.96	375.72	393.49	(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)	
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	30.01	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	30.01	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	58.7	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	58.7	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	96.68	(76)

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East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	96.68	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	141	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	141	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	172.8	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	172.8	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	176.89	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	176.89	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	168.41	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	168.41	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	144.66	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	144.66	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	112.44	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	112.44	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	69.66	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	69.66	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	37.42	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	37.42	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	24.68	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	24.68	(76)
South	0.9x	0.77	x	1.9	x	46.75	x	0.53	x	0.7	=	22.84	(78)
South	0.9x	0.77	x	1.9	x	76.57	x	0.53	x	0.7	=	37.4	(78)
South	0.9x	0.77	x	1.9	x	97.53	x	0.53	x	0.7	=	47.64	(78)
South	0.9x	0.77	x	1.9	x	110.23	x	0.53	x	0.7	=	53.85	(78)
South	0.9x	0.77	x	1.9	x	114.87	x	0.53	x	0.7	=	56.11	(78)
South	0.9x	0.77	x	1.9	x	110.55	x	0.53	x	0.7	=	54	(78)
South	0.9x	0.77	x	1.9	x	108.01	x	0.53	x	0.7	=	52.76	(78)
South	0.9x	0.77	x	1.9	x	104.89	x	0.53	x	0.7	=	51.24	(78)
South	0.9x	0.77	x	1.9	x	101.89	x	0.53	x	0.7	=	49.77	(78)
South	0.9x	0.77	x	1.9	x	82.59	x	0.53	x	0.7	=	40.34	(78)
South	0.9x	0.77	x	1.9	x	55.42	x	0.53	x	0.7	=	27.07	(78)
South	0.9x	0.77	x	1.9	x	40.4	x	0.53	x	0.7	=	19.73	(78)
West	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.8	=	23.66	(80)
West	0.9x	0.77	x	5.1	x	19.64	x	0.53	x	0.8	=	29.43	(80)
West	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.8	=	46.29	(80)
West	0.9x	0.77	x	5.1	x	38.42	x	0.53	x	0.8	=	57.57	(80)
West	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.8	=	76.23	(80)
West	0.9x	0.77	x	5.1	x	63.27	x	0.53	x	0.8	=	94.82	(80)
West	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.8	=	111.17	(80)
West	0.9x	0.77	x	5.1	x	92.28	x	0.53	x	0.8	=	138.29	(80)
West	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.8	=	136.24	(80)
West	0.9x	0.77	x	5.1	x	113.09	x	0.53	x	0.8	=	169.47	(80)

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West	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.8	=	139.47	(80)
West	0.9x	0.77	x	5.1	x	115.77	x	0.53	x	0.8	=	173.49	(80)
West	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.8	=	132.78	(80)
West	0.9x	0.77	x	5.1	x	110.22	x	0.53	x	0.8	=	165.17	(80)
West	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.8	=	114.06	(80)
West	0.9x	0.77	x	5.1	x	94.68	x	0.53	x	0.8	=	141.88	(80)
West	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.8	=	88.65	(80)
West	0.9x	0.77	x	5.1	x	73.59	x	0.53	x	0.8	=	110.28	(80)
West	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.8	=	54.92	(80)
West	0.9x	0.77	x	5.1	x	45.59	x	0.53	x	0.8	=	68.32	(80)
West	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.8	=	29.5	(80)
West	0.9x	0.77	x	5.1	x	24.49	x	0.53	x	0.8	=	36.7	(80)
West	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.8	=	19.46	(80)
West	0.9x	0.77	x	5.1	x	16.15	x	0.53	x	0.8	=	24.2	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	135.95	258.67	412.04	585.3	707.43	720.74	687.52	596.49	473.58	302.9	168.11	112.75	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	540.03	660.77	801.46	954.26	1055.66	1048.93	1002.64	917.33	804.88	654.86	543.82	506.24	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.92	0.75	0.54	0.37	0.27	0.31	0.52	0.86	0.98	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.49	20.75	20.94	20.99	21	21	21	21	20.89	20.54	20.25	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.19	20.19	20.2	20.21	20.21	20.22	20.22	20.23	20.22	20.21	20.21	20.2	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.9	0.71	0.5	0.33	0.22	0.25	0.47	0.82	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.54	19.9	20.15	20.21	20.22	20.22	20.23	20.22	20.1	19.63	19.2	(90)

fLA = Living area ÷ (4) = | 0.37 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.62	19.89	20.21	20.44	20.5	20.51	20.51	20.51	20.5	20.39	19.97	19.59	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.62	19.89	20.21	20.44	20.5	20.51	20.51	20.51	20.5	20.39	19.97	19.59	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.97	0.9	0.72	0.51	0.34	0.24	0.27	0.49	0.83	0.97	0.99	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	534.33	639.61	719.01	687.83	543.62	361.21	239.11	250.53	392.47	545.26	528.91	502.42	(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=	980.35	955.39	871.13	720.89	547.44	361.43	239.13	250.57	394.4	609.13	806.37	970.91	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	331.83	212.21	113.17	23.81	2.84	0	0	0	0	47.52	199.77	348.56	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1279.71 (98)

Space heating requirement in kWh/m²/year 17.43 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1279.71	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1599.63	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		2038.06	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2547.57	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	41.47	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		191.18	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	191.18	(331)
Energy for lighting (calculated in Appendix L)		322.91	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-477.54	(333)

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Electricity generated by wind turbine (Appendix M) (negative quantity)				0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)					
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel			319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52 =	674.73	(367)
Electrical energy for heat distribution	[(313) x		0.52 =	21.52	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)		=	696.26	(373)
CO2 associated with space heating (secondary)	(309) x		0 =	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52 =	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =			696.26	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52 =	99.23	(378)
CO2 associated with electricity for lighting	(332))) x		0.52 =	167.59	(379)
Energy saving/generation technologies (333) to (334) as applicable					
Item 1		0.52	x 0.01 =	-247.84	(380)
Total CO2, kg/year	sum of (376)…(382) =			715.23	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =			9.74	(384)
EI rating (section 14)				91.91	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: C85_Be Green

Address :

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	73.4	(1a) x	2.8	(2a) =	205.52	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	73.4	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		205.52	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *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*		0	(11)
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)

Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used

Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.34	0.36	0.38	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²	U-value W/m2K	A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x 1.2	= 3			(26)
Doors Type 2			2.5	x 1.2	= 3			(26)
Windows Type 1			1.18	x1/[1/(1.4)+ 0.04]	= 1.56			(27)
Windows Type 2			2.55	x1/[1/(1.4)+ 0.04]	= 3.38			(27)
Windows Type 3			1.61	x1/[1/(1.4)+ 0.04]	= 2.13			(27)
Windows Type 4			3.17	x1/[1/(1.4)+ 0.04]	= 4.2			(27)
Windows Type 5			1.61	x1/[1/(1.4)+ 0.04]	= 2.13			(27)
Walls	83.16	18.34	64.82	x 0.18	= 11.67			(29)
Total area of elements, m²			83.16					(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.35 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 39.51 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	40.16	39.91	39.68	38.56	38.35	37.38	37.38	37.2	37.75	38.35	38.77	39.21	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	79.67	79.43	79.19	78.07	77.86	76.89	76.89	76.71	77.27	77.86	78.29	78.73	

Average = Sum(39)$_{1…12}$ /12= 78.07 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.09	1.08	1.08	1.06	1.06	1.05	1.05	1.05	1.05	1.06	1.07	1.07

Average = Sum(40)$_{1\ldots12}$ /12= 1.06 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (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 89.44 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	98.38	94.8	91.23	87.65	84.07	80.49	80.49	84.07	87.65	91.23	94.8	98.38

Total = Sum(44)$_{1\ldots12}$ = 1073.24 (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=	145.9	127.6	131.67	114.8	110.15	95.05	88.08	101.07	102.28	119.2	130.11	141.29

Total = Sum(45)$_{1\ldots12}$ = 1407.19 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.88	19.14	19.75	17.22	16.52	14.26	13.21	15.16	15.34	17.88	19.52	21.19	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89	(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=	192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89	

Output from water heater (annual)1…12 | 1955.81 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	85.79	76.1	81.06	74.24	73.9	67.68	66.56	70.88	70.08	76.91	79.34	84.26	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	116.29	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	18.32	16.27	13.23	10.02	7.49	6.32	6.83	8.88	11.92	15.13	17.66	18.83	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	205.1	207.23	201.86	190.45	176.03	162.49	153.44	151.31	156.67	168.09	182.5	196.05	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	34.63	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	-93.03	(71)
Water heating gains (Table 5)													
(72)m=	115.3	113.24	108.95	103.12	99.33	94	89.46	95.27	97.33	103.37	110.19	113.25	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	399.61	397.62	384.93	364.46	343.74	323.69	310.62	316.35	326.81	347.48	371.24	389.01	(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)	
East	0.9x	0.77	x	1.61	x	19.64	x	0.63	x	0.7	=	19.33	(76)
East	0.9x	0.77	x	1.61	x	19.64	x	0.63	x	0.7	=	19.33	(76)
East	0.9x	0.77	x	1.61	x	38.42	x	0.63	x	0.7	=	37.81	(76)
East	0.9x	0.77	x	1.61	x	38.42	x	0.63	x	0.7	=	37.81	(76)
East	0.9x	0.77	x	1.61	x	63.27	x	0.63	x	0.7	=	62.27	(76)

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East	0.9x	0.77	x	1.61	x	63.27	x	0.63	x	0.7	=	62.27	(76)
East	0.9x	0.77	x	1.61	x	92.28	x	0.63	x	0.7	=	90.81	(76)
East	0.9x	0.77	x	1.61	x	92.28	x	0.63	x	0.7	=	90.81	(76)
East	0.9x	0.77	x	1.61	x	113.09	x	0.63	x	0.7	=	111.29	(76)
East	0.9x	0.77	x	1.61	x	113.09	x	0.63	x	0.7	=	111.29	(76)
East	0.9x	0.77	x	1.61	x	115.77	x	0.63	x	0.7	=	113.93	(76)
East	0.9x	0.77	x	1.61	x	115.77	x	0.63	x	0.7	=	113.93	(76)
East	0.9x	0.77	x	1.61	x	110.22	x	0.63	x	0.7	=	108.46	(76)
East	0.9x	0.77	x	1.61	x	110.22	x	0.63	x	0.7	=	108.46	(76)
East	0.9x	0.77	x	1.61	x	94.68	x	0.63	x	0.7	=	93.17	(76)
East	0.9x	0.77	x	1.61	x	94.68	x	0.63	x	0.7	=	93.17	(76)
East	0.9x	0.77	x	1.61	x	73.59	x	0.63	x	0.7	=	72.42	(76)
East	0.9x	0.77	x	1.61	x	73.59	x	0.63	x	0.7	=	72.42	(76)
East	0.9x	0.77	x	1.61	x	45.59	x	0.63	x	0.7	=	44.86	(76)
East	0.9x	0.77	x	1.61	x	45.59	x	0.63	x	0.7	=	44.86	(76)
East	0.9x	0.77	x	1.61	x	24.49	x	0.63	x	0.7	=	24.1	(76)
East	0.9x	0.77	x	1.61	x	24.49	x	0.63	x	0.7	=	24.1	(76)
East	0.9x	0.77	x	1.61	x	16.15	x	0.63	x	0.7	=	15.89	(76)
East	0.9x	0.77	x	1.61	x	16.15	x	0.63	x	0.7	=	15.89	(76)
South	0.9x	0.77	x	1.18	x	46.75	x	0.63	x	0.7	=	16.86	(78)
South	0.9x	0.77	x	1.18	x	76.57	x	0.63	x	0.7	=	27.61	(78)
South	0.9x	0.77	x	1.18	x	97.53	x	0.63	x	0.7	=	35.17	(78)
South	0.9x	0.77	x	1.18	x	110.23	x	0.63	x	0.7	=	39.75	(78)
South	0.9x	0.77	x	1.18	x	114.87	x	0.63	x	0.7	=	41.43	(78)
South	0.9x	0.77	x	1.18	x	110.55	x	0.63	x	0.7	=	39.87	(78)
South	0.9x	0.77	x	1.18	x	108.01	x	0.63	x	0.7	=	38.95	(78)
South	0.9x	0.77	x	1.18	x	104.89	x	0.63	x	0.7	=	37.83	(78)
South	0.9x	0.77	x	1.18	x	101.89	x	0.63	x	0.7	=	36.74	(78)
South	0.9x	0.77	x	1.18	x	82.59	x	0.63	x	0.7	=	29.78	(78)
South	0.9x	0.77	x	1.18	x	55.42	x	0.63	x	0.7	=	19.98	(78)
South	0.9x	0.77	x	1.18	x	40.4	x	0.63	x	0.7	=	14.57	(78)
West	0.9x	0.77	x	2.55	x	19.64	x	0.63	x	0.7	=	15.31	(80)
West	0.9x	0.77	x	3.17	x	19.64	x	0.63	x	0.7	=	19.03	(80)
West	0.9x	0.77	x	2.55	x	38.42	x	0.63	x	0.7	=	29.94	(80)
West	0.9x	0.77	x	3.17	x	38.42	x	0.63	x	0.7	=	37.22	(80)
West	0.9x	0.77	x	2.55	x	63.27	x	0.63	x	0.7	=	49.31	(80)
West	0.9x	0.77	x	3.17	x	63.27	x	0.63	x	0.7	=	61.3	(80)
West	0.9x	0.77	x	2.55	x	92.28	x	0.63	x	0.7	=	71.92	(80)
West	0.9x	0.77	x	3.17	x	92.28	x	0.63	x	0.7	=	89.4	(80)
West	0.9x	0.77	x	2.55	x	113.09	x	0.63	x	0.7	=	88.13	(80)
West	0.9x	0.77	x	3.17	x	113.09	x	0.63	x	0.7	=	109.56	(80)

West	0.9x	0.77	x	2.55	x	115.77	x	0.63	x	0.7	=	90.22	(80)
West	0.9x	0.77	x	3.17	x	115.77	x	0.63	x	0.7	=	112.16	(80)
West	0.9x	0.77	x	2.55	x	110.22	x	0.63	x	0.7	=	85.89	(80)
West	0.9x	0.77	x	3.17	x	110.22	x	0.63	x	0.7	=	106.78	(80)
West	0.9x	0.77	x	2.55	x	94.68	x	0.63	x	0.7	=	73.78	(80)
West	0.9x	0.77	x	3.17	x	94.68	x	0.63	x	0.7	=	91.72	(80)
West	0.9x	0.77	x	2.55	x	73.59	x	0.63	x	0.7	=	57.35	(80)
West	0.9x	0.77	x	3.17	x	73.59	x	0.63	x	0.7	=	71.29	(80)
West	0.9x	0.77	x	2.55	x	45.59	x	0.63	x	0.7	=	35.53	(80)
West	0.9x	0.77	x	3.17	x	45.59	x	0.63	x	0.7	=	44.17	(80)
West	0.9x	0.77	x	2.55	x	24.49	x	0.63	x	0.7	=	19.08	(80)
West	0.9x	0.77	x	3.17	x	24.49	x	0.63	x	0.7	=	23.72	(80)
West	0.9x	0.77	x	2.55	x	16.15	x	0.63	x	0.7	=	12.59	(80)
West	0.9x	0.77	x	3.17	x	16.15	x	0.63	x	0.7	=	15.65	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	89.85	170.39	270.31	382.69	461.71	470.1	448.55	389.67	310.22	199.2	110.99	74.59	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	489.45	568.01	655.24	747.15	805.44	793.79	759.17	706.01	637.03	546.68	482.23	463.6	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.92	0.79	0.6	0.44	0.49	0.76	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.07	20.34	20.67	20.89	20.98	21	20.99	20.94	20.63	20.21	19.88	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.01	20.02	20.02	20.03	20.03	20.04	20.04	20.05	20.04	20.03	20.03	20.02	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.9	0.74	0.52	0.35	0.39	0.68	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.56	18.8	19.19	19.65	19.93	20.03	20.04	20.04	19.99	19.61	19.01	18.53	(90)

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.06	19.27	19.61	20.03	20.28	20.38	20.39	20.39	20.34	19.98	19.45	19.03	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.06	19.27	19.61	20.03	20.28	20.38	20.39	20.39	20.34	19.98	19.45	19.03	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.99	0.97	0.9	0.76	0.55	0.38	0.43	0.71	0.94	0.99	1	(94)

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Useful gains, hmGm , W = (94)m x (84)m

(95)m=	486.61	560.75	632.86	671.45	608.24	435.85	290.7	304.48	450.78	512.21	476.27	461.53	(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=	1175.76	1141.44	1038.55	868.76	668.44	444.5	291.71	306.35	482.09	730.72	966.92	1167.55	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	512.73	390.23	301.83	142.06	44.79	0	0	0	0	162.57	353.27	525.28

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2432.76 (98)

Space heating requirement in kWh/m²/year 33.14 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	512.73	390.23	301.83	142.06	44.79	0	0	0	0	162.57	353.27	525.28	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	548.37	417.35	322.82	151.94	47.9	0	0	0	0	173.87	377.83	561.8	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2601.88 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10...12}$= 0 (215)

Water heating

Output from water heater (calculated above)

192.49	169.69	178.27	159.89	156.74	140.14	134.67	147.67	147.37	165.79	175.2	187.89

Efficiency of water heater 79.8 (216)

(217)m=	87.3	86.97	86.21	84.5	81.95	79.8	79.8	79.8	79.8	84.76	86.65	87.41	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	220.48	195.12	206.79	189.21	191.26	175.62	168.76	185.04	184.67	195.6	202.2	214.94

Total = Sum(219a)$_{1...12}$ = 2329.7 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2601.88
Water heating fuel used		2329.7
Electricity for pumps, fans and electric keep-hot		
central heating pump:	30	(230c)

boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			323.47	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	562.01	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	503.22	(264)
Space and water heating	(261) + (262) + (263) + (264) =			1065.22	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	167.88	(268)
Total CO2, kg/year		sum of (265)…(271) =		1272.03	(272)

TER =	25.31	(273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:

Stroma Number:

Software Name: Stroma FSAP 2012

Software Version: Version: 1.0.4.26

Property Address: A25_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.8	(2a) =	140	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	140	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			1.3		x1/[1/(1.3)+ 0.04]	=	1.61			(27)
Windows Type 2			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 3			1.9		x1/[1/(1.3)+ 0.04]	=	2.35			(27)
Windows Type 4			4.1		x1/[1/(1.3)+ 0.04]	=	5.07			(27)
Windows Type 5			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Walls	67.76	17.5	50.26	x	0.15	=	7.54			(29)
Total area of elements, m²			67.76							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.74 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 32.12 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	12.94	12.79	12.64	11.91	11.76	11.02	11.02	10.88	11.32	11.76	12.06	12.35	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	45.06	44.91	44.77	44.03	43.88	43.15	43.15	43	43.44	43.88	44.18	44.47	

Average = Sum(39)$_{1…12}$ /12= 43.99 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.9	0.9	0.9	0.88	0.88	0.86	0.86	0.86	0.87	0.88	0.88	0.89

Average = Sum(40)$_{1...12}$ /12= 0.88 (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 1.69 (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 74.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	
										Total = Sum(44)$_{1...12}$ =		892.08	(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=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	
										Total = Sum(45)$_{1...12}$ =		1169.66	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	174.85	154.46	163.03	147.27	145.14	130.86	126.79	137.59	136.87	152.66	160	171.02	(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=	174.85	154.46	163.03	147.27	145.14	130.86	126.79	137.59	136.87	152.66	160	171.02	

Output from water heater (annual)$_{1...12}$ 1800.52 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	83.19	73.98	79.26	73.21	73.31	67.75	67.21	70.8	69.75	75.81	77.44	81.91	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.13	11.66	9.48	7.18	5.37	4.53	4.89	6.36	8.54	10.84	12.66	13.49	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	0	0	0	0	0	0	0	0	0	0	0	0	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)
Water heating gains (Table 5)													
(72)m=	111.81	110.09	106.53	101.68	98.53	94.1	90.33	95.16	96.87	101.89	107.56	110.1	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	320.52	318.86	309.27	293.92	278.62	263.62	253.73	258.49	266.23	281.75	299.58	312.68	(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 m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	13.13	(76)
East	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.8	=	23.66	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	25.68	(76)
East	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.8	=	46.29	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	42.3	(76)

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East	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.8	=	76.23	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	61.69	(76)
East	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.8	=	111.17	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	75.6	(76)
East	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.8	=	136.24	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	77.39	(76)
East	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.8	=	139.47	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	73.68	(76)
East	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.8	=	132.78	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	63.29	(76)
East	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.8	=	114.06	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	49.19	(76)
East	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.8	=	88.65	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	30.47	(76)
East	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.8	=	54.92	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	16.37	(76)
East	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.8	=	29.5	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	10.8	(76)
East	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.8	=	19.46	(76)
South	0.9x	0.77	x	1.3	x	46.75	x	0.53	x	0.7	=	15.63	(78)
South	0.9x	0.77	x	1.3	x	76.57	x	0.53	x	0.7	=	25.59	(78)
South	0.9x	0.77	x	1.3	x	97.53	x	0.53	x	0.7	=	32.6	(78)
South	0.9x	0.77	x	1.3	x	110.23	x	0.53	x	0.7	=	36.84	(78)
South	0.9x	0.77	x	1.3	x	114.87	x	0.53	x	0.7	=	38.39	(78)
South	0.9x	0.77	x	1.3	x	110.55	x	0.53	x	0.7	=	36.95	(78)
South	0.9x	0.77	x	1.3	x	108.01	x	0.53	x	0.7	=	36.1	(78)
South	0.9x	0.77	x	1.3	x	104.89	x	0.53	x	0.7	=	35.06	(78)
South	0.9x	0.77	x	1.3	x	101.89	x	0.53	x	0.7	=	34.05	(78)
South	0.9x	0.77	x	1.3	x	82.59	x	0.53	x	0.7	=	27.6	(78)
South	0.9x	0.77	x	1.3	x	55.42	x	0.53	x	0.7	=	18.52	(78)
South	0.9x	0.77	x	1.3	x	40.4	x	0.53	x	0.7	=	13.5	(78)
West	0.9x	0.77	x	1.9	x	19.64	x	0.53	x	0.8	=	10.96	(80)
West	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.8	=	15	(80)
West	0.9x	0.77	x	1.9	x	38.42	x	0.53	x	0.8	=	21.45	(80)
West	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.8	=	29.35	(80)
West	0.9x	0.77	x	1.9	x	63.27	x	0.53	x	0.8	=	35.32	(80)
West	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.8	=	48.34	(80)
West	0.9x	0.77	x	1.9	x	92.28	x	0.53	x	0.8	=	51.52	(80)
West	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.8	=	70.5	(80)
West	0.9x	0.77	x	1.9	x	113.09	x	0.53	x	0.8	=	63.14	(80)
West	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.8	=	86.4	(80)

West	0.9x	0.77	x	1.9	x	115.77	x	0.53	x	0.8	=	64.63	(80)
West	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.8	=	88.44	(80)
West	0.9x	0.77	x	1.9	x	110.22	x	0.53	x	0.8	=	61.53	(80)
West	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.8	=	84.2	(80)
West	0.9x	0.77	x	1.9	x	94.68	x	0.53	x	0.8	=	52.86	(80)
West	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.8	=	72.33	(80)
West	0.9x	0.77	x	1.9	x	73.59	x	0.53	x	0.8	=	41.08	(80)
West	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.8	=	56.22	(80)
West	0.9x	0.77	x	1.9	x	45.59	x	0.53	x	0.8	=	25.45	(80)
West	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.8	=	34.83	(80)
West	0.9x	0.77	x	1.9	x	24.49	x	0.53	x	0.8	=	13.67	(80)
West	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.8	=	18.71	(80)
West	0.9x	0.77	x	1.9	x	16.15	x	0.53	x	0.8	=	9.02	(80)
West	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.8	=	12.34	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	78.39	148.36	234.78	331.72	399.77	406.88	388.3	337.59	269.2	173.28	96.78	65.11	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	398.91	467.23	544.05	625.64	678.39	670.51	642.02	596.08	535.44	455.03	396.35	377.79	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.97	0.92	0.78	0.59	0.41	0.3	0.33	0.55	0.86	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.3	20.47	20.71	20.92	20.99	21	21	21	20.99	20.87	20.55	20.27	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.17	20.17	20.17	20.18	20.19	20.2	20.2	20.2	20.19	20.19	20.18	20.18	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.97	0.91	0.75	0.54	0.36	0.24	0.27	0.49	0.83	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.5	19.83	20.1	20.18	20.2	20.2	20.2	20.19	20.06	19.62	19.21	(90)

fLA = Living area ÷ (4) = | 0.42 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.68	19.9	20.2	20.44	20.51	20.53	20.53	20.53	20.52	20.4	20.01	19.65	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.68	19.9	20.2	20.44	20.51	20.53	20.53	20.53	20.52	20.4	20.01	19.65	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.97	0.91	0.76	0.56	0.38	0.26	0.3	0.52	0.84	0.97	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	393.09	450.99	493.11	474.74	381.74	255.57	169.63	177.68	276.87	380.81	382.89	373.57	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	693.04	673.79	613.08	508.03	386.71	255.91	169.66	177.74	279.05	429.93	570.2	686.93	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	223.16	149.72	89.25	23.97	3.7	0	0	0	0	36.54	134.86	233.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ =	894.35	(98)
Space heating requirement in kWh/m²/year	17.89	(99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		894.35	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1117.93	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308
Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)
Water heating			
Annual water heating requirement		1800.52	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2250.65	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	33.69	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		130.23	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	130.23	(331)
Energy for lighting (calculated in Appendix L)		231.81	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-329.34	(333)

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Electricity generated by wind turbine (Appendix M) (negative quantity)			0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	548.05	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	17.48	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	565.54	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				565.54	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	67.59	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	120.31	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1		0.52		x 0.01 =	-170.93	(380)
Total CO2, kg/year	sum of (376)…(382) =				582.51	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.65	(384)
EI rating (section 14)					91.78	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: A25_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	50	(1a) x	2.8	(2a) =	140	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	50	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		140	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(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) =	20 ÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(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

0.43	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.38	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Windows Type 2			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Windows Type 3			1.14	x1/[1/(1.4)+ 0.04]		=	1.51			(27)
Windows Type 4			2.46	x1/[1/(1.4)+ 0.04]		=	3.26			(27)
Windows Type 5			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Walls	67.76	12.5	55.26	x	0.18	=	9.95			(29)
Total area of elements, m²			67.76							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.89 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.38 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.27 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	27.29	27.12	26.97	26.22	26.08	25.42	25.42	25.3	25.68	26.08	26.36	26.66	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	56.56	56.4	56.24	55.49	55.35	54.7	54.7	54.58	54.95	55.35	55.64	55.93	

Average = Sum(39)$_{1…12}$ /12= 55.49 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.13	1.13	1.12	1.11	1.11	1.09	1.09	1.09	1.1	1.11	1.11	1.12

Average = Sum(40)$_{1…12}$ /12= 1.11 (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 1.69 (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 74.34 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	81.77	78.8	75.83	72.85	69.88	66.91	66.91	69.88	72.85	75.83	78.8	81.77	
										Total = Sum(44)$_{1…12}$ =		892.08	(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=	121.27	106.06	109.45	95.42	91.56	79.01	73.21	84.01	85.01	99.08	108.15	117.44	
										Total = Sum(45)$_{1…12}$ =		1169.66	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.19	15.91	16.42	14.31	13.73	11.85	10.98	12.6	12.75	14.86	16.22	17.62	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	(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=	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04	

Output from water heater (annual)$_{1...12}$ 1718.27 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	77.6	68.93	73.67	67.8	67.72	62.34	61.62	65.21	64.34	70.22	72.03	76.33	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	84.51	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	13.24	11.76	9.56	7.24	5.41	4.57	4.94	6.42	8.61	10.94	12.76	13.61	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	147.23	148.76	144.91	136.72	126.37	116.64	110.15	108.62	112.47	120.67	131.01	140.74	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	31.45	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	-67.6	(71)
Water heating gains (Table 5)													
(72)m=	104.3	102.58	99.01	94.17	91.02	86.59	82.82	87.65	89.36	94.38	100.05	102.59	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	316.12	314.45	304.84	289.47	274.15	259.15	249.26	254.04	261.8	277.33	295.17	308.28	(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)	
East	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36	(76)
East	0.9x	0.77	x	2.46	x	19.64	x	0.63	x	0.7	=	14.77	(76)
East	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32	(76)
East	0.9x	0.77	x	2.46	x	38.42	x	0.63	x	0.7	=	28.88	(76)
East	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(76)

TER WorkSheet: New dwelling design stage

East	0.9x	0.77	x	2.46	x	63.27	x	0.63	x	0.7	=	47.57	(76)
East	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(76)
East	0.9x	0.77	x	2.46	x	92.28	x	0.63	x	0.7	=	69.38	(76)
East	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(76)
East	0.9x	0.77	x	2.46	x	113.09	x	0.63	x	0.7	=	85.02	(76)
East	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(76)
East	0.9x	0.77	x	2.46	x	115.77	x	0.63	x	0.7	=	87.04	(76)
East	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(76)
East	0.9x	0.77	x	2.46	x	110.22	x	0.63	x	0.7	=	82.86	(76)
East	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(76)
East	0.9x	0.77	x	2.46	x	94.68	x	0.63	x	0.7	=	71.18	(76)
East	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(76)
East	0.9x	0.77	x	2.46	x	73.59	x	0.63	x	0.7	=	55.32	(76)
East	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(76)
East	0.9x	0.77	x	2.46	x	45.59	x	0.63	x	0.7	=	34.27	(76)
East	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(76)
East	0.9x	0.77	x	2.46	x	24.49	x	0.63	x	0.7	=	18.41	(76)
East	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(76)
East	0.9x	0.77	x	2.46	x	16.15	x	0.63	x	0.7	=	12.14	(76)
South	0.9x	0.77	x	0.78	x	46.75	x	0.63	x	0.7	=	11.14	(78)
South	0.9x	0.77	x	0.78	x	76.57	x	0.63	x	0.7	=	18.25	(78)
South	0.9x	0.77	x	0.78	x	97.53	x	0.63	x	0.7	=	23.25	(78)
South	0.9x	0.77	x	0.78	x	110.23	x	0.63	x	0.7	=	26.28	(78)
South	0.9x	0.77	x	0.78	x	114.87	x	0.63	x	0.7	=	27.38	(78)
South	0.9x	0.77	x	0.78	x	110.55	x	0.63	x	0.7	=	26.35	(78)
South	0.9x	0.77	x	0.78	x	108.01	x	0.63	x	0.7	=	25.75	(78)
South	0.9x	0.77	x	0.78	x	104.89	x	0.63	x	0.7	=	25	(78)
South	0.9x	0.77	x	0.78	x	101.89	x	0.63	x	0.7	=	24.29	(78)
South	0.9x	0.77	x	0.78	x	82.59	x	0.63	x	0.7	=	19.69	(78)
South	0.9x	0.77	x	0.78	x	55.42	x	0.63	x	0.7	=	13.21	(78)
South	0.9x	0.77	x	0.78	x	40.4	x	0.63	x	0.7	=	9.63	(78)
West	0.9x	0.77	x	1.14	x	19.64	x	0.63	x	0.7	=	6.84	(80)
West	0.9x	0.77	x	1.56	x	19.64	x	0.63	x	0.7	=	9.36	(80)
West	0.9x	0.77	x	1.14	x	38.42	x	0.63	x	0.7	=	13.39	(80)
West	0.9x	0.77	x	1.56	x	38.42	x	0.63	x	0.7	=	18.32	(80)
West	0.9x	0.77	x	1.14	x	63.27	x	0.63	x	0.7	=	22.04	(80)
West	0.9x	0.77	x	1.56	x	63.27	x	0.63	x	0.7	=	30.17	(80)
West	0.9x	0.77	x	1.14	x	92.28	x	0.63	x	0.7	=	32.15	(80)
West	0.9x	0.77	x	1.56	x	92.28	x	0.63	x	0.7	=	44	(80)
West	0.9x	0.77	x	1.14	x	113.09	x	0.63	x	0.7	=	39.4	(80)
West	0.9x	0.77	x	1.56	x	113.09	x	0.63	x	0.7	=	53.92	(80)

West	0.9x	0.77	x	1.14	x	115.77	x	0.63	x	0.7	=	40.33	(80)
West	0.9x	0.77	x	1.56	x	115.77	x	0.63	x	0.7	=	55.19	(80)
West	0.9x	0.77	x	1.14	x	110.22	x	0.63	x	0.7	=	38.4	(80)
West	0.9x	0.77	x	1.56	x	110.22	x	0.63	x	0.7	=	52.55	(80)
West	0.9x	0.77	x	1.14	x	94.68	x	0.63	x	0.7	=	32.98	(80)
West	0.9x	0.77	x	1.56	x	94.68	x	0.63	x	0.7	=	45.14	(80)
West	0.9x	0.77	x	1.14	x	73.59	x	0.63	x	0.7	=	25.64	(80)
West	0.9x	0.77	x	1.56	x	73.59	x	0.63	x	0.7	=	35.08	(80)
West	0.9x	0.77	x	1.14	x	45.59	x	0.63	x	0.7	=	15.88	(80)
West	0.9x	0.77	x	1.56	x	45.59	x	0.63	x	0.7	=	21.73	(80)
West	0.9x	0.77	x	1.14	x	24.49	x	0.63	x	0.7	=	8.53	(80)
West	0.9x	0.77	x	1.56	x	24.49	x	0.63	x	0.7	=	11.68	(80)
West	0.9x	0.77	x	1.14	x	16.15	x	0.63	x	0.7	=	5.63	(80)
West	0.9x	0.77	x	1.56	x	16.15	x	0.63	x	0.7	=	7.7	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	51.48	97.16	153.2	215.79	259.64	264.11	252.11	219.44	175.42	113.31	63.5	42.8	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	367.6	411.61	458.03	505.27	533.79	523.26	501.36	473.48	437.22	390.65	358.68	351.08	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.93	0.82	0.64	0.47	0.52	0.77	0.95	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.91	20.06	20.31	20.62	20.86	20.97	20.99	20.99	20.92	20.61	20.21	19.89	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.98	19.98	19.98	19.99	20	20.01	20.01	20.01	20	20	19.99	19.99	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.97	0.91	0.77	0.55	0.37	0.41	0.69	0.93	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.54	18.75	19.11	19.56	19.86	19.99	20	20	19.94	19.56	18.98	18.51	(90)

fLA = Living area ÷ (4) = 0.42 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.11	19.29	19.61	20	20.27	20.4	20.42	20.42	20.35	20	19.49	19.08	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.11	19.29	19.61	20	20.27	20.4	20.42	20.42	20.35	20	19.49	19.08	(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

Utilisation factor for gains, hm:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(94)m=	0.99	0.98	0.96	0.91	0.79	0.59	0.41	0.46	0.72	0.93	0.98	0.99	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	364.47	405.17	441.96	459.07	419.2	307.55	207.49	217.05	316.53	364.09	352.67	348.67	(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=	837.52	811.83	737.19	615.97	474.64	317.06	208.74	219.15	343.49	520.32	689.5	832.35	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	351.95	273.27	219.65	112.97	41.25	0	0	0	0	116.24	242.52	359.86

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1717.71 (98)

Space heating requirement in kWh/m²/year 34.35 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year	
Space heating requirement (calculated above)														
	351.95	273.27	219.65	112.97	41.25	0	0	0	0	116.24	242.52	359.86		
(211)m = {[(98)m x (204)] } x 100 ÷ (206)														(211)
	376.42	292.27	234.92	120.82	44.11	0	0	0	0	124.32	259.38	384.88		
Total (kWh/year) =Sum(211)$_{1...5,10...12}$=													1837.12	(211)
Space heating fuel (secondary), kWh/month = {[(98)m x (201)] } x 100 ÷ (208)														
(215)m=	0	0	0	0	0	0	0	0	0	0	0	0		
Total (kWh/year) =Sum(215)$_{1...5,10...12}$=													0	(215)

Water heating

Output from water heater (calculated above)														
	167.86	148.15	156.04	140.51	138.15	124.1	119.81	130.61	130.11	145.67	153.24	164.04		
Efficiency of water heater													79.8	(216)
(217)m=	86.74	86.43	85.73	84.24	82.03	79.8	79.8	79.8	79.8	84.22	86.03	86.85		(217)
Fuel for water heating, kWh/month (219)m = (64)m x 100 ÷ (217)m														
(219)m=	193.52	171.42	182.02	166.8	168.42	155.51	150.13	163.67	163.04	172.97	178.12	188.87		
Total = Sum(219a)$_{1...12}$ =													2054.47	(219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1837.12	
Water heating fuel used		2054.47	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)

boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			233.78	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year	**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211) x	0.216	=	396.82	(261)
Space heating (secondary)	(215) x	0.519	=	0	(263)
Water heating	(219) x	0.216	=	443.76	(264)
Space and water heating	(261) + (262) + (263) + (264) =			840.58	(265)
Electricity for pumps, fans and electric keep-hot	(231) x	0.519	=	38.93	(267)
Electricity for lighting	(232) x	0.519	=	121.33	(268)
Total CO2, kg/year		sum of (265)…(271) =		1000.84	(272)

TER = 29.26 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:
Stroma Number:
Software Name: Stroma FSAP 2012
Software Version: Version: 1.0.4.26

Property Address: B57_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.1	(1a) x	2.8	(2a) =	196.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.1	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	196.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.3	=	3.12			(26)
Windows Type 1			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 2			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 4			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 5			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	22.96	23	-0.04	x	0.15	=	-0.01			(29)
Walls Type2	8.12	0	8.12	x	0.14	=	1.15			(29)
Walls Type3	12.04	0	12.04	x	0.13	=	1.59			(29)
Total area of elements, m²			43.12							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.31 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.47 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

DER WorkSheet: New dwelling design stage

(38)m=	18.14	17.93	17.73	16.7	16.49	15.46	15.46	15.25	15.87	16.49	16.9	17.31	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	51.61	51.4	51.19	50.16	49.95	48.92	48.92	48.72	49.33	49.95	50.37	50.78	

Average = $Sum(39)_{1...12}$ /12= 50.11 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.74	0.73	0.73	0.72	0.71	0.7	0.7	0.69	0.7	0.71	0.72	0.72	

Average = $Sum(40)_{1...12}$ /12= 0.71 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (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 87.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	96.36	92.86	89.36	85.85	82.35	78.84	78.84	82.35	85.85	89.36	92.86	96.36	

Total = $Sum(44)_{1...12}$ = 1051.24 (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=	142.9	124.98	128.97	112.44	107.89	93.1	86.27	99	100.18	116.75	127.44	138.39	

Total = $Sum(45)_{1...12}$ = 1378.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.44	18.75	19.35	16.87	16.18	13.97	12.94	14.85	15.03	17.51	19.12	20.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(57)

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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	196.48	173.38	182.55	164.29	161.47	144.95	139.85	152.58	152.03	170.33	179.3	191.98	(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=	196.48	173.38	182.55	164.29	161.47	144.95	139.85	152.58	152.03	170.33	179.3	191.98

Output from water heater (annual)$_{1...12}$ | 2009.2 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	90.38	80.27	85.75	78.87	78.74	72.44	71.55	75.78	74.79	81.68	83.86	88.88	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	17.61	15.64	12.72	9.63	7.2	6.08	6.57	8.54	11.46	14.55	16.98	18.1	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	197.53	199.58	194.41	183.42	169.54	156.49	147.78	145.73	150.89	161.89	175.77	188.81	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	(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=	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	(71)
Water heating gains (Table 5)													
(72)m=	121.48	119.45	115.25	109.54	105.83	100.61	96.17	101.86	103.88	109.79	116.47	119.46	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	393.35	391.4	379.12	359.32	339.3	319.91	307.24	312.85	322.95	342.95	365.94	383.11	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)
North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)

North	0.9x	0.77	x	2.6	x	10.63	x	0.53	x	0.7	=	14.22	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	20.32	x	0.53	x	0.7	=	27.17	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	34.53	x	0.53	x	0.7	=	46.16	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	55.46	x	0.53	x	0.7	=	74.15	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	74.72	x	0.53	x	0.7	=	99.89	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	79.99	x	0.53	x	0.7	=	106.94	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	74.68	x	0.53	x	0.7	=	99.84	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	59.25	x	0.53	x	0.7	=	79.21	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	41.52	x	0.53	x	0.7	=	55.5	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	24.19	x	0.53	x	0.7	=	32.34	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	13.12	x	0.53	x	0.7	=	17.54	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
North	0.9x	0.77	x	2.6	x	8.86	x	0.53	x	0.7	=	11.85	(74)
Northeast	0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast	0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast	0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast	0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast	0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)
Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)

Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	48.3	93.01	159.22	256.49	345.42	369.58	345.14	274	191.77	111.08	59.72	40.17	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	441.65	484.41	538.33	615.81	684.72	689.49	652.38	586.85	514.72	454.03	425.67	423.27	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.97	0.88	0.67	0.45	0.33	0.38	0.65	0.93	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.39	20.5	20.68	20.9	20.99	21	21	21	20.99	20.86	20.59	20.37	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.31	20.31	20.31	20.33	20.33	20.34	20.34	20.35	20.34	20.33	20.32	20.32	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.96	0.85	0.62	0.41	0.28	0.33	0.59	0.91	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.49	19.65	19.91	20.22	20.32	20.34	20.34	20.35	20.33	20.17	19.8	19.48	(90)

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.89	20.03	20.26	20.53	20.62	20.64	20.64	20.64	20.63	20.48	20.16	19.88	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.89	20.03	20.26	20.53	20.62	20.64	20.64	20.64	20.63	20.48	20.16	19.88	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	0.99	0.99	0.96	0.86	0.64	0.43	0.3	0.35	0.62	0.92	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	439.12	478.57	518.6	527.46	439.18	295.11	197.53	206.48	318.58	415.79	419.62	421.41	(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=	804.69	777.61	704.39	583.13	445.56	295.37	197.55	206.52	322.1	493.67	657.67	796.18	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	271.99	200.96	138.23	40.08	4.74	0	0	0	0	57.95	171.39	278.83

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1164.18 (98)

Space heating requirement in kWh/m²/year 16.61 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.25 (306)

Space heating **kWh/year**

Annual space heating requirement 1164.18

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 1455.23 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

Space heating requirement from secondary/supplementary system (98) x (301) x 100 ÷ (308) = 0 (309)

Water heating

Annual water heating requirement 2009.2

If DHW from community scheme:

Water heat from Community heat pump (64) x (303a) x (305) x (306) = 2511.5 (310a)

Electricity used for heat distribution 0.01 × [(307a)…(307e) + (310a)…(310e)] = 39.67 (313)

Cooling System Energy Efficiency Ratio 0 (314)

Space cooling (if there is a fixed cooling system, if not enter 0) = (107) ÷ (314) = 0 (315)

Electricity for pumps and fans within dwelling (Table 4f):

mechanical ventilation - balanced, extract or positive input from outside 182.59 (330a)

warm air heating system fans 0 (330b)

pump for solar water heating 0 (330g)

Total electricity for the above, kWh/year =(330a) + (330b) + (330g) = 182.59 (331)

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Energy for lighting (calculated in Appendix L)			311	(332)
Electricity generated by PVs (Appendix M) (negative quantity)			-461.08	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)			0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP)						
Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	645.37	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	20.59	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	665.96	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				665.96	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	94.76	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	161.41	(379)
Energy saving/generation technologies (333) to (334) as applicable						
Item 1			0.52	x 0.01 =	-239.3	(380)
Total CO2, kg/year	sum of (376)…(382) =				682.83	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				9.74	(384)
EI rating (section 14)					92.05	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B57_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	70.1	(1a) x	2.8	(2a) =	196.28	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	70.1	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		196.28	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans =	(6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.15	(8)

If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)

Number of storeys in the dwelling (ns)		0	(9)
Additional infiltration	[(9)-1]x0.1 =	0	(10)
Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction		0	(11)
if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35			
If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0		0	(12)
If no draught lobby, enter 0.05, else enter 0		0	(13)
Percentage of windows and doors draught stripped		0	(14)
Window infiltration	0.25 - [0.2 x (14) ÷ 100] =	0	(15)
Infiltration rate	(8) + (10) + (11) + (12) + (13) + (15) =	0	(16)
Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area		5	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.4	(18)
Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used			
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.85	(20)
Infiltration rate incorporating shelter factor	(21) = (18) x (20) =	0.34	(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

0.44	0.43	0.42	0.38	0.37	0.33	0.33	0.32	0.34	0.37	0.39	0.4

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.6	0.59	0.59	0.57	0.57	0.55	0.55	0.55	0.56	0.57	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.2	=	2.88			(26)
Windows Type 1			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 2			1.76	x1/[1/(1.4)+ 0.04]		=	2.33			(27)
Windows Type 3			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 4			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Windows Type 5			1.91	x1/[1/(1.4)+ 0.04]		=	2.53			(27)
Walls Type1	22.96	17.53	5.43	x	0.18	=	0.98			(29)
Walls Type2	8.12	0	8.12	x	0.18	=	1.46			(29)
Walls Type3	12.04	0	12.04	x	0.18	=	2.17			(29)
Total area of elements, m²			43.12							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 27.54 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 2.16 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 29.7 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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(38)m=	38.56	38.32	38.08	36.98	36.77	35.81	35.81	35.64	36.18	36.77	37.19	37.63	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	68.26	68.02	67.78	66.68	66.47	65.51	65.51	65.34	65.88	66.47	66.89	67.33	

Average = $Sum(39)_{1...12}$ /12= 66.68 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.97	0.97	0.97	0.95	0.95	0.93	0.93	0.93	0.94	0.95	0.95	0.96	

Average = $Sum(40)_{1...12}$ /12= 0.95 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.25 (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 87.6 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	96.36	92.86	89.36	85.85	82.35	78.84	78.84	82.35	85.85	89.36	92.86	96.36	

Total = $Sum(44)_{1...12}$ = 1051.24 (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=	142.9	124.98	128.97	112.44	107.89	93.1	86.27	99	100.18	116.75	127.44	138.39	

Total = $Sum(45)_{1...12}$ = 1378.34 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	21.44	18.75	19.35	16.87	16.18	13.97	12.94	14.85	15.03	17.51	19.12	20.76	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(57)

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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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99	(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=	189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99	

Output from water heater (annual)$_{1...12}$ | 1926.95 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	84.79	75.23	80.16	73.46	73.15	67.03	65.96	70.19	69.38	76.1	78.45	83.29	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	112.43	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	17.62	15.65	12.73	9.64	7.2	6.08	6.57	8.54	11.46	14.55	16.99	18.11	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	197.53	199.58	194.41	183.42	169.54	156.49	147.78	145.73	150.89	161.89	175.77	188.81	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	34.24	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	-89.94	(71)

Water heating gains (Table 5)

(72)m=	113.97	111.94	107.74	102.03	98.32	93.1	88.66	94.35	96.37	102.28	108.96	111.95	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	388.85	386.9	374.61	354.81	334.79	315.4	302.73	308.34	318.45	338.45	361.44	378.6	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:		Access Factor Table 6d		Area m²		Flux Table 6a		g_ Table 6b		FF Table 6c		Gains (W)	
North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)

North	0.9x	0.77	x	1.91	x	10.63	x	0.63	x	0.7	=	12.41	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	20.32	x	0.63	x	0.7	=	23.72	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	34.53	x	0.63	x	0.7	=	40.31	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	55.46	x	0.63	x	0.7	=	64.75	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	74.72	x	0.63	x	0.7	=	87.23	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	79.99	x	0.63	x	0.7	=	93.38	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	74.68	x	0.63	x	0.7	=	87.18	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	59.25	x	0.63	x	0.7	=	69.17	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	41.52	x	0.63	x	0.7	=	48.47	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	24.19	x	0.63	x	0.7	=	28.24	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	13.12	x	0.63	x	0.7	=	15.31	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
North	0.9x	0.77	x	1.91	x	8.86	x	0.63	x	0.7	=	10.35	(74)
Northeast	0.9x	0.3	x	1.76	x	11.28	x	0.63	x	0.7	=	2.36	(75)
Northeast	0.9x	0.3	x	1.91	x	11.28	x	0.63	x	0.7	=	2.57	(75)
Northeast	0.9x	0.3	x	1.76	x	22.97	x	0.63	x	0.7	=	4.81	(75)
Northeast	0.9x	0.3	x	1.91	x	22.97	x	0.63	x	0.7	=	5.22	(75)
Northeast	0.9x	0.3	x	1.76	x	41.38	x	0.63	x	0.7	=	8.67	(75)
Northeast	0.9x	0.3	x	1.91	x	41.38	x	0.63	x	0.7	=	9.41	(75)
Northeast	0.9x	0.3	x	1.76	x	67.96	x	0.63	x	0.7	=	14.24	(75)

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Northeast 0.9x	0.3	x	1.91	x	67.96	x	0.63	x	0.7	=	15.45	(75)
Northeast 0.9x	0.3	x	1.76	x	91.35	x	0.63	x	0.7	=	19.14	(75)
Northeast 0.9x	0.3	x	1.91	x	91.35	x	0.63	x	0.7	=	20.77	(75)
Northeast 0.9x	0.3	x	1.76	x	97.38	x	0.63	x	0.7	=	20.41	(75)
Northeast 0.9x	0.3	x	1.91	x	97.38	x	0.63	x	0.7	=	22.15	(75)
Northeast 0.9x	0.3	x	1.76	x	91.1	x	0.63	x	0.7	=	19.09	(75)
Northeast 0.9x	0.3	x	1.91	x	91.1	x	0.63	x	0.7	=	20.72	(75)
Northeast 0.9x	0.3	x	1.76	x	72.63	x	0.63	x	0.7	=	15.22	(75)
Northeast 0.9x	0.3	x	1.91	x	72.63	x	0.63	x	0.7	=	16.52	(75)
Northeast 0.9x	0.3	x	1.76	x	50.42	x	0.63	x	0.7	=	10.57	(75)
Northeast 0.9x	0.3	x	1.91	x	50.42	x	0.63	x	0.7	=	11.47	(75)
Northeast 0.9x	0.3	x	1.76	x	28.07	x	0.63	x	0.7	=	5.88	(75)
Northeast 0.9x	0.3	x	1.91	x	28.07	x	0.63	x	0.7	=	6.38	(75)
Northeast 0.9x	0.3	x	1.76	x	14.2	x	0.63	x	0.7	=	2.98	(75)
Northeast 0.9x	0.3	x	1.91	x	14.2	x	0.63	x	0.7	=	3.23	(75)
Northeast 0.9x	0.3	x	1.76	x	9.21	x	0.63	x	0.7	=	1.93	(75)
Northeast 0.9x	0.3	x	1.91	x	9.21	x	0.63	x	0.7	=	2.1	(75)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	42.17	81.21	139.02	223.95	301.6	322.69	301.35	239.24	167.44	96.98	52.15	35.07	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	431.02	468.11	513.63	578.76	636.38	638.09	604.08	547.58	485.89	435.43	413.59	413.68	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	1	0.99	0.96	0.84	0.64	0.47	0.54	0.83	0.97	1	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.02	20.13	20.34	20.65	20.89	20.98	21	20.99	20.93	20.63	20.28	20	(87)

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.11	20.11	20.11	20.12	20.13	20.14	20.14	20.14	20.13	20.13	20.12	20.12	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.98	0.94	0.8	0.56	0.38	0.44	0.76	0.96	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.79	18.95	19.26	19.71	20.02	20.13	20.14	20.14	20.07	19.69	19.19	18.78	(90)

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.34	19.48	19.75	20.13	20.41	20.51	20.52	20.52	20.46	20.11	19.68	19.33	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.34	19.48	19.75	20.13	20.41	20.51	20.52	20.52	20.46	20.11	19.68	19.33	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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Utilisation factor for gains, hm:

(94)m=	1	0.99	0.98	0.94	0.81	0.59	0.42	0.49	0.79	0.96	0.99	1	(94)

Useful gains, hmGm , W = (94)m x (84)m

(95)m=	429.32	464.84	504.77	543.8	516.25	379.24	256.14	267.38	381.5	419.07	410.26	412.38	(95)

Monthly average external temperature from Table 8

(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]

(97)m=	1026.69	991.85	898.06	748.8	578.78	387.28	257.06	269.38	418.8	632.31	841.31	1018.56	(97)

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

(98)m=	444.44	354.15	292.61	147.6	46.52	0	0	0	0	158.65	310.35	451

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2205.32 (98)

Space heating requirement in kWh/m²/year 31.46 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system 0 (201)

Fraction of space heat from main system(s) (202) = 1 – (201) = 1 (202)

Fraction of total heating from main system 1 (204) = (202) × [1 – (203)] = 1 (204)

Efficiency of main space heating system 1 93.5 (206)

Efficiency of secondary/supplementary heating system, % 0 (208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	444.44	354.15	292.61	147.6	46.52	0	0	0	0	158.65	310.35	451	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	475.34	378.76	312.95	157.86	49.76	0	0	0	0	169.68	331.93	482.35	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 2358.63 (211)

Space heating fuel (secondary), kWh/month

= {[(98)m x (201)] } x 100 ÷ (208)

(215)m=	0	0	0	0	0	0	0	0	0	0	0	0

Total (kWh/year) =Sum(215)$_{1...5,10....12}$= 0 (215)

Water heating

Output from water heater (calculated above)

189.5	167.07	175.57	157.53	154.49	138.19	132.87	145.59	145.27	163.35	172.53	184.99

Efficiency of water heater 79.8 (216)

(217)m=	87.01	86.77	86.17	84.64	82.05	79.8	79.8	79.8	79.8	84.74	86.36	87.1	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	217.78	192.54	203.75	186.12	188.29	173.17	166.5	182.45	182.05	192.77	199.78	212.38

Total = Sum(219a)$_{1...12}$ = 2297.59 (219)

Annual totals	**kWh/year**	**kWh/year**
Space heating fuel used, main system 1		2358.63
Water heating fuel used		2297.59
Electricity for pumps, fans and electric keep-hot		

central heating pump:			30			(230c)
boiler with a fan-assisted flue			45			(230e)
Total electricity for the above, kWh/year		sum of (230a)…(230g) =			75	(231)
Electricity for lighting					311.17	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	509.46	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	496.28	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1005.74	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	161.5	(268)
Total CO2, kg/year			sum of (265)…(271) =		1206.17	(272)

TER = 25.1 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: C114_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)			Av. Height(m)			Volume(m³)	
Ground floor	39.2	(1a)	x	2.8	(2a)	=	109.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.2	(4)						
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n)	=	109.76	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							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 *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*		0	(11)
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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.3	=	3.25			(26)
Doors Type 2			2.5	x	1	=	2.5			(26)
Windows Type 1			4.1		x1/[1/(1.3)+ 0.04]	=	5.07			(27)
Windows Type 2			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 3			1.3		x1/[1/(1.3)+ 0.04]	=	1.61			(27)
Walls	29.12	13	16.12	x	0.15	=	2.42			(29)
Roof	39.2	0	39.2	x	0.1	=	3.92			(30)
Total area of elements, m²			68.32							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 21.97 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.42 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 25.39 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	10.14	10.03	9.91	9.34	9.22	8.64	8.64	8.53	8.87	9.22	9.45	9.68	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	35.53	35.42	35.3	34.73	34.61	34.03	34.03	33.92	34.26	34.61	34.84	35.07	

Average = Sum(39)$_{1…12}$ /12= 34.7 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.91	0.9	0.9	0.89	0.88	0.87	0.87	0.87	0.87	0.88	0.89	0.89

Average = Sum(40)$_{1…12}$ /12= 0.89 (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 1.39 (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 67.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.81	71.13	68.44	65.76	63.07	60.39	60.39	63.07	65.76	68.44	71.13	73.81	
											Total = Sum(44)$_{1…12}$ =	805.19	(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=	109.46	95.73	98.79	86.12	82.64	71.31	66.08	75.83	76.73	89.43	97.61	106	
											Total = Sum(45)$_{1…12}$ =	1055.74	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	16.42	14.36	14.82	12.92	12.4	10.7	9.91	11.37	11.51	13.41	14.64	15.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	163.04	144.13	152.37	137.98	136.22	123.16	119.66	129.41	128.59	143.01	149.47	159.58	(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=	163.04	144.13	152.37	137.98	136.22	123.16	119.66	129.41	128.59	143.01	149.47	159.58	

Output from water heater (annual)$_{1...12}$ 1686.6 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	79.26	70.55	75.71	70.12	70.34	65.19	64.84	68.08	67	72.6	73.94	78.11	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	10.66	9.47	7.7	5.83	4.36	3.68	3.97	5.17	6.93	8.8	10.28	10.95	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	119.53	120.77	117.64	110.99	102.59	94.69	89.42	88.18	91.31	97.96	106.36	114.25	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(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=	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	(71)

Water heating gains (Table 5)

(72)m=	106.53	104.98	101.76	97.39	94.55	90.55	87.15	91.5	93.05	97.58	102.69	104.99	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	280.49	278.99	270.88	257.98	245.27	232.7	224.32	228.63	235.07	248.12	263.1	273.97	(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)	
East	0.9x	0.3	x	1.3	x	19.64	x	0.53	x	0.8	=	2.92	(76)
East	0.9x	0.3	x	1.3	x	38.42	x	0.53	x	0.8	=	5.72	(76)
East	0.9x	0.3	x	1.3	x	63.27	x	0.53	x	0.8	=	9.42	(76)
East	0.9x	0.3	x	1.3	x	92.28	x	0.53	x	0.8	=	13.73	(76)
East	0.9x	0.3	x	1.3	x	113.09	x	0.53	x	0.8	=	16.83	(76)

East	0.9x	0.3	x	1.3	x	115.77	x	0.53	x	0.8	=	17.23	(76)
East	0.9x	0.3	x	1.3	x	110.22	x	0.53	x	0.8	=	16.4	(76)
East	0.9x	0.3	x	1.3	x	94.68	x	0.53	x	0.8	=	14.09	(76)
East	0.9x	0.3	x	1.3	x	73.59	x	0.53	x	0.8	=	10.95	(76)
East	0.9x	0.3	x	1.3	x	45.59	x	0.53	x	0.8	=	6.78	(76)
East	0.9x	0.3	x	1.3	x	24.49	x	0.53	x	0.8	=	3.64	(76)
East	0.9x	0.3	x	1.3	x	16.15	x	0.53	x	0.8	=	2.4	(76)
West	0.9x	0.77	x	4.1	x	19.64	x	0.53	x	0.7	=	20.7	(80)
West	0.9x	0.3	x	2.6	x	19.64	x	0.53	x	0.8	=	5.85	(80)
West	0.9x	0.77	x	4.1	x	38.42	x	0.53	x	0.7	=	40.5	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.53	x	0.8	=	11.44	(80)
West	0.9x	0.77	x	4.1	x	63.27	x	0.53	x	0.7	=	66.7	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.53	x	0.8	=	18.83	(80)
West	0.9x	0.77	x	4.1	x	92.28	x	0.53	x	0.7	=	97.27	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.53	x	0.8	=	27.47	(80)
West	0.9x	0.77	x	4.1	x	113.09	x	0.53	x	0.7	=	119.21	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.53	x	0.8	=	33.66	(80)
West	0.9x	0.77	x	4.1	x	115.77	x	0.53	x	0.7	=	122.04	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.53	x	0.8	=	34.46	(80)
West	0.9x	0.77	x	4.1	x	110.22	x	0.53	x	0.7	=	116.18	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.53	x	0.8	=	32.81	(80)
West	0.9x	0.77	x	4.1	x	94.68	x	0.53	x	0.7	=	99.8	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.53	x	0.8	=	28.18	(80)
West	0.9x	0.77	x	4.1	x	73.59	x	0.53	x	0.7	=	77.57	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.53	x	0.8	=	21.9	(80)
West	0.9x	0.77	x	4.1	x	45.59	x	0.53	x	0.7	=	48.06	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.53	x	0.8	=	13.57	(80)
West	0.9x	0.77	x	4.1	x	24.49	x	0.53	x	0.7	=	25.81	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.53	x	0.8	=	7.29	(80)
West	0.9x	0.77	x	4.1	x	16.15	x	0.53	x	0.7	=	17.03	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.53	x	0.8	=	4.81	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	29.47	57.65	94.95	138.47	169.71	173.72	165.39	142.07	110.43	68.41	36.75	24.24	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	309.97	336.65	365.83	396.46	414.97	406.42	389.71	370.7	345.49	316.53	299.85	298.21	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.96	0.89	0.73	0.53	0.38	0.42	0.66	0.91	0.98	0.99	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.28	20.4	20.6	20.83	20.96	21	21	21	20.98	20.82	20.52	20.26	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.16	20.16	20.17	20.18	20.18	20.19	20.19	20.2	20.19	20.18	20.18	20.17	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.95	0.86	0.68	0.47	0.31	0.35	0.59	0.88	0.97	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.22	19.39	19.67	19.99	20.14	20.19	20.19	20.2	20.18	19.99	19.57	19.2	(90)

fLA = Living area ÷ (4) = 0.69 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.96	20.09	20.31	20.57	20.71	20.75	20.75	20.75	20.74	20.56	20.23	19.94	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.96	20.09	20.31	20.57	20.71	20.75	20.75	20.75	20.74	20.56	20.23	19.94	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.95	0.87	0.72	0.51	0.36	0.4	0.64	0.9	0.97	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	306.05	329.25	347.88	345.25	296.86	207.74	141.19	147.4	221.49	283.62	291.98	295.11	(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=	556.33	538.02	487.64	405.22	311.73	209.27	141.34	147.66	227.35	344.89	457.5	551.93	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	186.21	140.29	103.98	43.18	11.06	0	0	0	0	45.58	119.17	191.07	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 840.55 (98)

Space heating requirement in kWh/m²/year 21.44 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none	0	(301)
Fraction of space heat from community system 1 – (301) =	1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		840.55	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1050.69	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1686.6	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2108.25	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	31.59	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		114.36	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	114.36	(331)
Energy for lighting (calculated in Appendix L)		188.22	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-255.24	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	513.95	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	16.39	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	530.34	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				530.34	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	59.35	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	97.68	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52	x 0.01 =		-132.47	(380)
Total CO2, kg/year	sum of (376)…(382) =				554.91	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				14.16	(384)
EI rating (section 14)					91.17	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: C114_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	39.2	(1a) x	2.8	(2a) =	109.76	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	39.2	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		109.76	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(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) =	20 ÷ (5) =	0.18	(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)	0.43	(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) =	0.37	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

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Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.47	0.46	0.45	0.4	0.39	0.35	0.35	0.34	0.37	0.39	0.41	0.43

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.61	0.61	0.6	0.58	0.58	0.56	0.56	0.56	0.57	0.58	0.59	0.59	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.5	x	1.2	=	3			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			2.46	x1/[1/(1.4)+ 0.04]		=	3.26			(27)
Windows Type 2			1.56	x1/[1/(1.4)+ 0.04]		=	2.07			(27)
Windows Type 3			0.78	x1/[1/(1.4)+ 0.04]		=	1.03			(27)
Walls	29.12	9.8	19.32	x	0.18	=	3.48			(29)
Roof	39.2	0	39.2	x	0.13	=	5.1			(30)
Total area of elements, m²			68.32							(31)

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 20.94 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 3.42 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 24.35 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	22.08	21.93	21.78	21.07	20.94	20.32	20.32	20.2	20.55	20.94	21.2	21.49	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	46.44	46.28	46.13	45.42	45.29	44.67	44.67	44.56	44.91	45.29	45.56	45.84	

Average = Sum(39)$_{1…12}$ /12= 45.42 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.18	1.18	1.18	1.16	1.16	1.14	1.14	1.14	1.15	1.16	1.16	1.17

Average = Sum(40)$_{1...12}$ /12= 1.16 (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 1.39 (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 67.1 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	73.81	71.13	68.44	65.76	63.07	60.39	60.39	63.07	65.76	68.44	71.13	73.81	
										Total = Sum(44)$_{1...12}$ =		805.19	(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=	109.46	95.73	98.79	86.12	82.64	71.31	66.08	75.83	76.73	89.43	97.61	106	
										Total = Sum(45)$_{1...12}$ =		1055.74	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	16.42	14.36	14.82	12.92	12.4	10.7	9.91	11.37	11.51	13.41	14.64	15.9	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6	(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=	156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6	

Output from water heater (annual)1…12 1604.35 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	73.67	65.5	70.12	64.71	64.75	59.78	59.25	62.49	61.59	67.01	68.53	72.52	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m=	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	69.26	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	11.31	10.05	8.17	6.19	4.62	3.9	4.22	5.48	7.36	9.34	10.91	11.63	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	119.53	120.77	117.64	110.99	102.59	94.69	89.42	88.18	91.31	97.96	106.36	114.25	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	29.93	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	-55.41	(71)
Water heating gains (Table 5)													
(72)m=	99.02	97.47	94.25	89.87	87.03	83.03	79.63	83.99	85.54	90.07	95.18	97.48	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	276.64	275.06	266.84	253.83	241.02	228.41	220.05	224.43	230.98	244.15	259.22	270.13	(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)	
East	0.9x	0.3	x	0.78	x	19.64	x	0.63	x	0.7	=	1.82	(76)
East	0.9x	0.3	x	0.78	x	38.42	x	0.63	x	0.7	=	3.57	(76)
East	0.9x	0.3	x	0.78	x	63.27	x	0.63	x	0.7	=	5.88	(76)
East	0.9x	0.3	x	0.78	x	92.28	x	0.63	x	0.7	=	8.57	(76)
East	0.9x	0.3	x	0.78	x	113.09	x	0.63	x	0.7	=	10.5	(76)

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East	0.9x	0.3	x	0.78	x	115.77	x	0.63	x	0.7	=	10.75	(76)
East	0.9x	0.3	x	0.78	x	110.22	x	0.63	x	0.7	=	10.24	(76)
East	0.9x	0.3	x	0.78	x	94.68	x	0.63	x	0.7	=	8.79	(76)
East	0.9x	0.3	x	0.78	x	73.59	x	0.63	x	0.7	=	6.83	(76)
East	0.9x	0.3	x	0.78	x	45.59	x	0.63	x	0.7	=	4.23	(76)
East	0.9x	0.3	x	0.78	x	24.49	x	0.63	x	0.7	=	2.27	(76)
East	0.9x	0.3	x	0.78	x	16.15	x	0.63	x	0.7	=	1.5	(76)
West	0.9x	0.77	x	2.46	x	19.64	x	0.63	x	0.7	=	14.77	(80)
West	0.9x	0.3	x	1.56	x	19.64	x	0.63	x	0.7	=	3.65	(80)
West	0.9x	0.77	x	2.46	x	38.42	x	0.63	x	0.7	=	28.88	(80)
West	0.9x	0.3	x	1.56	x	38.42	x	0.63	x	0.7	=	7.14	(80)
West	0.9x	0.77	x	2.46	x	63.27	x	0.63	x	0.7	=	47.57	(80)
West	0.9x	0.3	x	1.56	x	63.27	x	0.63	x	0.7	=	11.75	(80)
West	0.9x	0.77	x	2.46	x	92.28	x	0.63	x	0.7	=	69.38	(80)
West	0.9x	0.3	x	1.56	x	92.28	x	0.63	x	0.7	=	17.14	(80)
West	0.9x	0.77	x	2.46	x	113.09	x	0.63	x	0.7	=	85.02	(80)
West	0.9x	0.3	x	1.56	x	113.09	x	0.63	x	0.7	=	21.01	(80)
West	0.9x	0.77	x	2.46	x	115.77	x	0.63	x	0.7	=	87.04	(80)
West	0.9x	0.3	x	1.56	x	115.77	x	0.63	x	0.7	=	21.5	(80)
West	0.9x	0.77	x	2.46	x	110.22	x	0.63	x	0.7	=	82.86	(80)
West	0.9x	0.3	x	1.56	x	110.22	x	0.63	x	0.7	=	20.47	(80)
West	0.9x	0.77	x	2.46	x	94.68	x	0.63	x	0.7	=	71.18	(80)
West	0.9x	0.3	x	1.56	x	94.68	x	0.63	x	0.7	=	17.59	(80)
West	0.9x	0.77	x	2.46	x	73.59	x	0.63	x	0.7	=	55.32	(80)
West	0.9x	0.3	x	1.56	x	73.59	x	0.63	x	0.7	=	13.67	(80)
West	0.9x	0.77	x	2.46	x	45.59	x	0.63	x	0.7	=	34.27	(80)
West	0.9x	0.3	x	1.56	x	45.59	x	0.63	x	0.7	=	8.47	(80)
West	0.9x	0.77	x	2.46	x	24.49	x	0.63	x	0.7	=	18.41	(80)
West	0.9x	0.3	x	1.56	x	24.49	x	0.63	x	0.7	=	4.55	(80)
West	0.9x	0.77	x	2.46	x	16.15	x	0.63	x	0.7	=	12.14	(80)
West	0.9x	0.3	x	1.56	x	16.15	x	0.63	x	0.7	=	3	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	20.24	39.59	65.2	95.09	116.53	119.29	113.57	97.56	75.83	46.98	25.23	16.64	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	296.87	314.65	332.04	348.92	357.56	347.7	333.62	321.99	306.81	291.13	284.46	286.78	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.99	0.98	0.96	0.89	0.74	0.57	0.61	0.84	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.86	19.97	20.18	20.49	20.76	20.93	20.99	20.98	20.87	20.54	20.16	19.84	(87)

TER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.93	19.94	19.94	19.95	19.96	19.97	19.97	19.97	19.96	19.96	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.94	0.85	0.65	0.45	0.49	0.76	0.95	0.99	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.43	18.59	18.91	19.35	19.71	19.92	19.96	19.96	19.86	19.44	18.88	18.42	(90)

fLA = Living area ÷ (4) = 0.69 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.42	19.55	19.79	20.14	20.44	20.63	20.67	20.67	20.56	20.21	19.77	19.41	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.42	19.55	19.79	20.14	20.44	20.63	20.67	20.67	20.56	20.21	19.77	19.41	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.71	0.53	0.57	0.81	0.95	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	294.35	310.75	324.46	330.53	312.06	248.06	178	184.59	248.69	276.97	280.15	284.7	(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=	702.1	677.91	613.25	510.44	395.69	269.15	181.94	190.21	290.31	435	577.14	697.05	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	303.37	246.73	214.85	129.54	62.22	0	0	0	0	117.58	213.83	306.78	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1594.9 (98)

Space heating requirement in kWh/m²/year 40.69 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	303.37	246.73	214.85	129.54	62.22	0	0	0	0	117.58	213.83	306.78	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	324.46	263.88	229.79	138.54	66.55	0	0	0	0	125.75	228.69	328.11	

Total (kWh/year) =Sum(211)$_{1...5,10....12}$= 1705.77 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

156.05	137.82	145.38	131.22	129.23	116.4	112.67	122.42	121.83	136.02	142.71	152.6

Efficiency of water heater 79.8 (216)

(217)m=	86.56	86.35	85.85	84.78	82.99	79.8	79.8	79.8	79.8	84.43	85.89	86.64	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	180.29	159.6	169.34	154.77	155.72	145.87	141.2	153.41	152.66	161.11	166.15	176.13

Total = Sum(219a)$_{1...12}$ = 1916.25 (219)

Annual totals	**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1		1705.77	
Water heating fuel used		1916.25	
Electricity for pumps, fans and electric keep-hot			
central heating pump:	30		(230c)
boiler with a fan-assisted flue	45		(230e)
Total electricity for the above, kWh/year sum of (230a)…(230g) =		75	(231)
Electricity for lighting		199.78	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	368.45	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	413.91	(264)
Space and water heating	(261) + (262) + (263) + (264) =				782.36	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	103.68	(268)
Total CO2, kg/year			sum of (265)…(271) =		924.97	(272)

TER = 34.57 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B76_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.5	(1a) x	2.8	(2a) =	211.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.5	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	211.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			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			3	(17)
If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16)			0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.3	=	3.12			(26)
Windows Type 1			2.4		x1/[1/(1.3)+ 0.04]	=	2.97			(27)
Windows Type 2			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 3			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 4			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 5			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Windows Type 6			2.6		x1/[1/(1.3)+ 0.04]	=	3.21			(27)
Walls Type1	60.48	28.2	32.28	x	0.15	=	4.84			(29)
Walls Type2	20.16	0	20.16	x	0.14	=	2.85			(29)
Roof	75.5	0	75.5	x	0.1	=	7.55			(30)
Total area of elements, m²			156.14							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 50.25 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 7.78 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 58.03 (37)

DER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	19.54	19.32	19.09	17.98	17.76	16.65	16.65	16.42	17.09	17.76	18.2	18.65	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	77.56	77.34	77.12	76.01	75.79	74.67	74.67	74.45	75.12	75.79	76.23	76.68	

Average = $Sum(39)_{1...12}$ /12= 75.95 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.03	1.02	1.02	1.01	1	0.99	0.99	0.99	0.99	1	1.01	1.02	

Average = $Sum(40)_{1...12}$ /12= 1.01 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (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 90.53 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	99.59	95.97	92.34	88.72	85.1	81.48	81.48	85.1	88.72	92.34	95.97	99.59	

Total = $Sum(44)_{1...12}$ = 1086.4 (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=	147.68	129.17	133.29	116.2	111.5	96.22	89.16	102.31	103.53	120.66	131.71	143.02	

Total = $Sum(45)_{1...12}$ = 1424.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.35	15.53	18.1	19.76	21.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	201.26	177.56	186.87	168.06	165.08	148.07	142.74	155.89	155.38	174.24	183.56	196.6	(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=	201.26	177.56	186.87	168.06	165.08	148.07	142.74	155.89	155.38	174.24	183.56	196.6

Output from water heater (annual)$_{1...12}$ — 2055.31 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	91.97	81.66	87.18	80.12	79.94	73.47	72.51	76.88	75.91	82.98	85.27	90.42	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.7	16.61	13.51	10.23	7.64	6.45	6.97	9.06	12.17	15.45	18.03	19.22	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.78	211.96	206.47	194.79	180.05	166.2	156.94	154.76	160.25	171.93	186.67	200.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	(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=	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	(71)

Water heating gains (Table 5)

(72)m=	123.61	121.52	117.18	111.28	107.44	102.05	97.46	103.34	105.43	111.54	118.44	121.53	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	410.68	408.67	395.74	374.88	353.72	333.28	319.95	325.74	336.42	357.49	381.71	399.86	(73)

6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

Orientation:	Access Factor Table 6d	Area m²	Flux Table 6a	g_ Table 6b	FF Table 6c	Gains (W)

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Northeast	0.9x	0.3	x	2.4	x	11.28	x	0.53	x	0.7	=	2.71	(75)
Northeast	0.9x	0.3	x	2.6	x	11.28	x	0.53	x	0.7	=	2.94	(75)
Northeast	0.9x	0.3	x	2.4	x	22.97	x	0.53	x	0.7	=	5.52	(75)
Northeast	0.9x	0.3	x	2.6	x	22.97	x	0.53	x	0.7	=	5.98	(75)
Northeast	0.9x	0.3	x	2.4	x	41.38	x	0.53	x	0.7	=	9.95	(75)
Northeast	0.9x	0.3	x	2.6	x	41.38	x	0.53	x	0.7	=	10.78	(75)
Northeast	0.9x	0.3	x	2.4	x	67.96	x	0.53	x	0.7	=	16.34	(75)
Northeast	0.9x	0.3	x	2.6	x	67.96	x	0.53	x	0.7	=	17.7	(75)
Northeast	0.9x	0.3	x	2.4	x	91.35	x	0.53	x	0.7	=	21.96	(75)
Northeast	0.9x	0.3	x	2.6	x	91.35	x	0.53	x	0.7	=	23.79	(75)
Northeast	0.9x	0.3	x	2.4	x	97.38	x	0.53	x	0.7	=	23.41	(75)
Northeast	0.9x	0.3	x	2.6	x	97.38	x	0.53	x	0.7	=	25.36	(75)
Northeast	0.9x	0.3	x	2.4	x	91.1	x	0.53	x	0.7	=	21.9	(75)
Northeast	0.9x	0.3	x	2.6	x	91.1	x	0.53	x	0.7	=	23.73	(75)
Northeast	0.9x	0.3	x	2.4	x	72.63	x	0.53	x	0.7	=	17.46	(75)
Northeast	0.9x	0.3	x	2.6	x	72.63	x	0.53	x	0.7	=	18.92	(75)
Northeast	0.9x	0.3	x	2.4	x	50.42	x	0.53	x	0.7	=	12.12	(75)
Northeast	0.9x	0.3	x	2.6	x	50.42	x	0.53	x	0.7	=	13.13	(75)
Northeast	0.9x	0.3	x	2.4	x	28.07	x	0.53	x	0.7	=	6.75	(75)
Northeast	0.9x	0.3	x	2.6	x	28.07	x	0.53	x	0.7	=	7.31	(75)
Northeast	0.9x	0.3	x	2.4	x	14.2	x	0.53	x	0.7	=	3.41	(75)
Northeast	0.9x	0.3	x	2.6	x	14.2	x	0.53	x	0.7	=	3.7	(75)
Northeast	0.9x	0.3	x	2.4	x	9.21	x	0.53	x	0.7	=	2.22	(75)
Northeast	0.9x	0.3	x	2.6	x	9.21	x	0.53	x	0.7	=	2.4	(75)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	19.64	x	0.53	x	0.7	=	26.26	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	38.42	x	0.53	x	0.7	=	51.37	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	63.27	x	0.53	x	0.7	=	84.59	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	92.28	x	0.53	x	0.7	=	123.37	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	113.09	x	0.53	x	0.7	=	151.2	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)

East	0.9x	0.77	x	2.6	x	115.77	x	0.53	x	0.7	=	154.78	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	110.22	x	0.53	x	0.7	=	147.35	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	94.68	x	0.53	x	0.7	=	126.58	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	73.59	x	0.53	x	0.7	=	98.38	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	45.59	x	0.53	x	0.7	=	60.95	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	24.49	x	0.53	x	0.7	=	32.74	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
East	0.9x	0.77	x	2.6	x	16.15	x	0.53	x	0.7	=	21.59	(76)
South	0.9x	0.77	x	2.6	x	46.75	x	0.53	x	0.7	=	62.5	(78)
South	0.9x	0.77	x	2.6	x	76.57	x	0.53	x	0.7	=	102.37	(78)
South	0.9x	0.77	x	2.6	x	97.53	x	0.53	x	0.7	=	130.4	(78)
South	0.9x	0.77	x	2.6	x	110.23	x	0.53	x	0.7	=	147.38	(78)
South	0.9x	0.77	x	2.6	x	114.87	x	0.53	x	0.7	=	153.58	(78)
South	0.9x	0.77	x	2.6	x	110.55	x	0.53	x	0.7	=	147.8	(78)
South	0.9x	0.77	x	2.6	x	108.01	x	0.53	x	0.7	=	144.4	(78)
South	0.9x	0.77	x	2.6	x	104.89	x	0.53	x	0.7	=	140.24	(78)
South	0.9x	0.77	x	2.6	x	101.89	x	0.53	x	0.7	=	136.21	(78)
South	0.9x	0.77	x	2.6	x	82.59	x	0.53	x	0.7	=	110.41	(78)
South	0.9x	0.77	x	2.6	x	55.42	x	0.53	x	0.7	=	74.09	(78)
South	0.9x	0.77	x	2.6	x	40.4	x	0.53	x	0.7	=	54.01	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	146.93	267.97	404.9	551.53	652.92	660.9	632.1	556.34	456.62	307.32	179.42	123.4	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	557.6	676.64	800.64	926.41	1006.64	994.18	952.05	882.08	793.04	664.81	561.14	523.26	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	0.99	0.98	0.95	0.85	0.67	0.48	0.34	0.39	0.63	0.91	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.06	20.26	20.54	20.83	20.96	21	21	21	20.98	20.77	20.35	20.02	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.06	20.06	20.07	20.08	20.08	20.09	20.09	20.09	20.09	20.08	20.08	20.07	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.98	0.94	0.81	0.61	0.41	0.27	0.31	0.56	0.88	0.98	0.99	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.81	19.11	19.51	19.89	20.05	20.09	20.09	20.09	20.07	19.83	19.26	18.77	(90)

fLA = Living area ÷ (4) = 0.44 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.36	19.61	19.96	20.3	20.44	20.48	20.49	20.49	20.47	20.24	19.73	19.32	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.36	19.61	19.96	20.3	20.44	20.48	20.49	20.49	20.47	20.24	19.73	19.32	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.98	0.93	0.82	0.64	0.44	0.3	0.34	0.59	0.89	0.98	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	552.59	660.53	747.35	758.39	639.53	437.01	290.06	303.93	467	588.81	549.34	519.79	(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=	1167.8	1137.94	1038.11	866.37	662.66	439.39	290.3	304.4	478.28	730.43	963.1	1158.98	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	457.72	320.82	216.33	77.74	17.21	0	0	0	0	105.37	297.91	475.56	

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1968.66 (98)

Space heating requirement in kWh/m²/year 26.07 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump 1 (303a)

Fraction of total space heat from Community heat pump (302) x (303a) = 1 (304a)

Factor for control and charging method (Table 4c(3)) for community heating system 1 (305)

Distribution loss factor (Table 12c) for community heating system 1.25 (306)

Space heating **kWh/year**

Annual space heating requirement 1968.66

Space heat from Community heat pump (98) x (304a) x (305) x (306) = 2460.83 (307a)

Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) 0 (308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		2055.31	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2569.14	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	50.3	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		196.65	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	196.65	(331)
Energy for lighting (calculated in Appendix L)		330.28	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-494.01	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	818.35	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	26.11	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	844.46	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				844.46	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	102.06	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	171.42	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-256.39	(380)
Total CO2, kg/year	sum of (376)…(382) =				861.55	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				11.41	(384)
EI rating (section 14)					90.42	(385)

TER WorkSheet: New dwelling design stage

User Details:

Assessor Name: | **Stroma Number:**
Software Name: Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.26

Property Address: B76_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	75.5	(1a) x	2.8	(2a) =	211.4	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	75.5	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		211.4	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							3	x 10 =	30	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

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			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30	÷ (5) =	0.14	(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)	0.39	(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) =	0.33	(21)

Infiltration rate modified for monthly wind speed

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly average wind speed from Table 7												
(22)m=	5.1	5	4.9	4.4	4.3	3.8	3.8	3.7	4	4.3	4.5	4.7
Wind Factor (22a)m = (22)m ÷ 4												
(22a)m=	1.27	1.25	1.23	1.1	1.08	0.95	0.95	0.92	1	1.08	1.12	1.18

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

0.42	0.42	0.41	0.37	0.36	0.32	0.32	0.31	0.33	0.36	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation:	0	(23a)
If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a)	0	(23b)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	0	(23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.59	0.58	0.57	0.56	0.55	0.55	0.55	0.56	0.56	0.57	0.58	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors			2.4	x	1.2	=	2.88			(26)
Windows Type 1			1.53	x1/[1/(1.4)+ 0.04]		=	2.03			(27)
Windows Type 2			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 3			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 4			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 5			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Windows Type 6			1.66	x1/[1/(1.4)+ 0.04]		=	2.2			(27)
Walls Type1	60.48	18.87	41.61	x	0.18	=	7.49			(29)
Walls Type2	20.16	0	20.16	x	0.18	=	3.63			(29)
Roof	75.5	0	75.5	x	0.13	=	9.81			(30)
Total area of elements, m²			156.14							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U)	(26)…(30) + (32) =	45.65	(33)
Heat capacity Cm = S(A x k)	((28)…(30) + (32) + (32a)…(32e) =	0	(34)
Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K	Indicative Value: Medium	250	(35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K		7.78	(36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss	(33) + (36) =	53.43	(37)

TER WorkSheet: New dwelling design stage

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	41.17	40.93	40.69	39.56	39.35	38.37	38.37	38.19	38.75	39.35	39.78	40.23	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	94.6	94.36	94.12	92.99	92.78	91.8	91.8	91.62	92.18	92.78	93.21	93.65	

Average = Sum(39)$_{1\ldots12}$ /12= 92.99 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.25	1.25	1.25	1.23	1.23	1.22	1.22	1.21	1.22	1.23	1.23	1.24	

Average = Sum(40)$_{1\ldots12}$ /12= 1.23 (40)

Number of days in month (Table 1a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(41)m=	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.37 (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 90.53 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

DRAFT

	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=	99.59	95.97	92.34	88.72	85.1	81.48	81.48	85.1	88.72	92.34	95.97	99.59	

Total = Sum(44)$_{1\ldots12}$ = 1086.4 (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=	147.68	129.17	133.29	116.2	111.5	96.22	89.16	102.31	103.53	120.66	131.71	143.02	

Total = Sum(45)$_{1\ldots12}$ = 1424.45 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	22.15	19.37	19.99	17.43	16.72	14.43	13.37	15.35	15.53	18.1	19.76	21.45	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62	(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=	194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62

Output from water heater (annual)$_{1...12}$ — 1973.06 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	86.38	76.62	81.59	74.71	74.35	68.07	66.92	71.29	70.5	77.39	79.87	84.83	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	118.6	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

(67)m=	18.7	16.61	13.51	10.23	7.64	6.45	6.97	9.06	12.17	15.45	18.03	19.22	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

(68)m=	209.78	211.96	206.47	194.79	180.05	166.2	156.94	154.76	160.25	171.93	186.67	200.52	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

(69)m=	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	34.86	(69)

Pumps and fans gains (Table 5a)

(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)

Losses e.g. evaporation (negative values) (Table 5)

(71)m=	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	-94.88	(71)

Water heating gains (Table 5)

(72)m=	116.1	114.01	109.67	103.77	99.93	94.54	89.95	95.83	97.91	104.02	110.92	114.02	(72)

Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

(73)m=	406.16	404.16	391.23	370.36	349.21	328.76	315.44	321.23	331.91	352.98	377.2	395.35	(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)

Northeast	0.9x	0.3	x	1.53	x	11.28	x	0.63	x	0.7	=	2.06	(75)
Northeast	0.9x	0.3	x	1.66	x	11.28	x	0.63	x	0.7	=	2.23	(75)
Northeast	0.9x	0.3	x	1.53	x	22.97	x	0.63	x	0.7	=	4.18	(75)
Northeast	0.9x	0.3	x	1.66	x	22.97	x	0.63	x	0.7	=	4.54	(75)
Northeast	0.9x	0.3	x	1.53	x	41.38	x	0.63	x	0.7	=	7.54	(75)
Northeast	0.9x	0.3	x	1.66	x	41.38	x	0.63	x	0.7	=	8.18	(75)
Northeast	0.9x	0.3	x	1.53	x	67.96	x	0.63	x	0.7	=	12.38	(75)
Northeast	0.9x	0.3	x	1.66	x	67.96	x	0.63	x	0.7	=	13.43	(75)
Northeast	0.9x	0.3	x	1.53	x	91.35	x	0.63	x	0.7	=	16.64	(75)
Northeast	0.9x	0.3	x	1.66	x	91.35	x	0.63	x	0.7	=	18.06	(75)
Northeast	0.9x	0.3	x	1.53	x	97.38	x	0.63	x	0.7	=	17.74	(75)
Northeast	0.9x	0.3	x	1.66	x	97.38	x	0.63	x	0.7	=	19.25	(75)
Northeast	0.9x	0.3	x	1.53	x	91.1	x	0.63	x	0.7	=	16.6	(75)
Northeast	0.9x	0.3	x	1.66	x	91.1	x	0.63	x	0.7	=	18.01	(75)
Northeast	0.9x	0.3	x	1.53	x	72.63	x	0.63	x	0.7	=	13.23	(75)
Northeast	0.9x	0.3	x	1.66	x	72.63	x	0.63	x	0.7	=	14.36	(75)
Northeast	0.9x	0.3	x	1.53	x	50.42	x	0.63	x	0.7	=	9.19	(75)
Northeast	0.9x	0.3	x	1.66	x	50.42	x	0.63	x	0.7	=	9.97	(75)
Northeast	0.9x	0.3	x	1.53	x	28.07	x	0.63	x	0.7	=	5.11	(75)
Northeast	0.9x	0.3	x	1.66	x	28.07	x	0.63	x	0.7	=	5.55	(75)
Northeast	0.9x	0.3	x	1.53	x	14.2	x	0.63	x	0.7	=	2.59	(75)
Northeast	0.9x	0.3	x	1.66	x	14.2	x	0.63	x	0.7	=	2.81	(75)
Northeast	0.9x	0.3	x	1.53	x	9.21	x	0.63	x	0.7	=	1.68	(75)
Northeast	0.9x	0.3	x	1.66	x	9.21	x	0.63	x	0.7	=	1.82	(75)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	19.64	x	0.63	x	0.7	=	19.93	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	38.42	x	0.63	x	0.7	=	38.98	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	63.27	x	0.63	x	0.7	=	64.2	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	92.28	x	0.63	x	0.7	=	93.63	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	113.09	x	0.63	x	0.7	=	114.75	(76)
East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)
East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)

East	0.9x	0.77	x	1.66	x	115.77	x	0.63	x	0.7	=	117.46	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	110.22	x	0.63	x	0.7	=	111.83	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	94.68	x	0.63	x	0.7	=	96.06	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	73.59	x	0.63	x	0.7	=	74.67	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	45.59	x	0.63	x	0.7	=	46.26	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	24.49	x	0.63	x	0.7	=	24.85	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
East	0.9x	0.77	x	1.66	x	16.15	x	0.63	x	0.7	=	16.39	(76)
South	0.9x	0.77	x	1.66	x	46.75	x	0.63	x	0.7	=	47.44	(78)
South	0.9x	0.77	x	1.66	x	76.57	x	0.63	x	0.7	=	77.69	(78)
South	0.9x	0.77	x	1.66	x	97.53	x	0.63	x	0.7	=	98.96	(78)
South	0.9x	0.77	x	1.66	x	110.23	x	0.63	x	0.7	=	111.85	(78)
South	0.9x	0.77	x	1.66	x	114.87	x	0.63	x	0.7	=	116.55	(78)
South	0.9x	0.77	x	1.66	x	110.55	x	0.63	x	0.7	=	112.17	(78)
South	0.9x	0.77	x	1.66	x	108.01	x	0.63	x	0.7	=	109.59	(78)
South	0.9x	0.77	x	1.66	x	104.89	x	0.63	x	0.7	=	106.43	(78)
South	0.9x	0.77	x	1.66	x	101.89	x	0.63	x	0.7	=	103.38	(78)
South	0.9x	0.77	x	1.66	x	82.59	x	0.63	x	0.7	=	83.79	(78)
South	0.9x	0.77	x	1.66	x	55.42	x	0.63	x	0.7	=	56.23	(78)
South	0.9x	0.77	x	1.66	x	40.4	x	0.63	x	0.7	=	40.99	(78)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	111.51	203.36	307.28	418.55	495.49	501.55	479.69	422.2	346.53	233.22	136.16	93.65	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	517.67	607.52	698.5	788.92	844.7	830.31	795.13	743.43	678.44	586.2	513.37	489	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.98	0.94	0.84	0.66	0.5	0.55	0.8	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.7	19.88	20.17	20.53	20.81	20.95	20.99	20.98	20.89	20.51	20.04	19.67	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	19.88	19.88	19.88	19.89	19.9	19.91	19.91	19.91	19.9	19.9	19.89	19.89	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.97	0.91	0.78	0.57	0.38	0.43	0.72	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.16	18.43	18.84	19.35	19.72	19.88	19.9	19.9	19.82	19.34	18.66	18.13	(90)

fLA = Living area ÷ (4) = 0.44 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	18.83	19.06	19.42	19.86	20.19	20.35	20.38	20.37	20.28	19.85	19.26	18.8	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	18.83	19.06	19.42	19.86	20.19	20.35	20.38	20.37	20.28	19.85	19.26	18.8	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.97	0.91	0.8	0.61	0.43	0.48	0.75	0.94	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	514.37	599.3	675.76	720.69	672.88	504.15	343.13	358.09	507.67	552.24	506.78	486.57	(95)
Monthly average external temperature from Table 8													
(96)m=	4.3	4.9	6.5	8.9	11.7	14.6	16.6	16.4	14.1	10.6	7.1	4.2	(96)
Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m]													
(97)m=	1374.9	1336.1	1216	1019.67	787.82	527.57	346.78	364.16	569.85	858.17	1133.66	1367.38	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	640.24	495.13	401.94	215.27	85.51	0	0	0	0	227.61	451.36	655.32	

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 3172.37 (98)

Space heating requirement in kWh/m²/year 42.02 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	640.24	495.13	401.94	215.27	85.51	0	0	0	0	227.61	451.36	655.32	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	684.75	529.55	429.88	230.23	91.46	0	0	0	0	243.43	482.73	700.88	

Total (kWh/year) =$Sum(211)_{1...5,10...12}$= 3392.91 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

194.28	171.25	179.88	161.3	158.09	141.31	135.75	148.91	148.62	167.25	176.8	189.62

Efficiency of water heater 79.8 (216)

(217)m=	87.76	87.49	86.9	85.58	83.26	79.8	79.8	79.8	79.8	85.64	87.21	87.86	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	221.37	195.75	207.01	188.46	189.89	177.08	170.12	186.6	186.25	195.3	202.73	215.83

Total = Sum(219a)$_{1...12}$ = 2336.38 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			3392.91	
Water heating fuel used			2336.38	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			330.28	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	732.87	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	504.66	(264)
Space and water heating	(261) + (262) + (263) + (264) =				1237.53	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	171.41	(268)
Total CO2, kg/year			sum of (265)…(271) =		1447.87	(272)

TER = 28.19 (273)

DER WorkSheet: New dwelling design stage

User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B79_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52	(1a) x	2.8	(2a) =	145.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)				
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =		145.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							0	x 10 =	0	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			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		3	(17)
If based on air permeability value, then	(18) = [(17) ÷ 20]+(8), otherwise (18) = (16)	0.15	(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) =	0.13	(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

0.16	0.16	0.16	0.14	0.14	0.12	0.12	0.12	0.13	0.14	0.14	0.15

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) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 76.5 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0	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=	0.28	0.28	0.27	0.26	0.25	0.24	0.24	0.24	0.24	0.25	0.26	0.27	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.4	x	1.3	=	3.12			(26)
Doors Type 2			2.5	x	1.3	=	3.25			(26)
Windows Type 1			2.4	x1/[1/(1.3)+ 0.04]		=	2.97			(27)
Windows Type 2			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Windows Type 3			2.6	x1/[1/(1.3)+ 0.04]		=	3.21			(27)
Walls Type1	33.32	12.5	20.82	x	0.15	=	3.12			(29)
Walls Type2	11.48	0	11.48	x	0.14	=	1.62			(29)
Roof	52	0	52	x	0.1	=	5.2			(30)
Total area of elements, m²			96.8							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 25.71 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.84 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 30.55 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	13.46	13.3	13.15	12.38	12.23	11.47	11.47	11.31	11.77	12.23	12.54	12.84	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	44.01	43.85	43.7	42.93	42.78	42.01	42.01	41.86	42.32	42.78	43.09	43.39	

Average = Sum(39)$_{1…12}$ /12= 42.9 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	0.85	0.84	0.84	0.83	0.82	0.81	0.81	0.81	0.81	0.82	0.83	0.83

Average = Sum(40)$_{1…12}$ /12= 0.82 (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 1.75 (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 75.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)

(44)m=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31

Total = Sum(44)$_{1…12}$ = 908.89 (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=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65

Total = Sum(45)$_{1…12}$ = 1191.69 (45)

If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)

(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.63 (48)

Temperature factor from Table 2b 0.6 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.98 (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) 0.98 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	30.32	27.38	30.32	29.34	30.32	29.34	30.32	30.32	29.34	30.32	29.34	30.32	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(59)

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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=	177.13	156.46	165.09	149.07	146.86	132.35	128.17	139.17	138.47	154.52	162.04	173.23	(62)

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

(63)m=	0	0	0	0	0	0	0	0	0	0	0	0	(63)

Output from water heater

(64)m=	177.13	156.46	165.09	149.07	146.86	132.35	128.17	139.17	138.47	154.52	162.04	173.23	

Output from water heater (annual)$_{1...12}$ 1822.56 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	83.95	74.65	79.94	73.81	73.88	68.25	67.67	71.32	70.28	76.43	78.12	82.65	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.31	12.71	10.33	7.82	5.85	4.94	5.34	6.93	9.31	11.82	13.79	14.7	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(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=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)
Water heating gains (Table 5)													
(72)m=	112.83	111.08	107.45	102.51	99.3	94.79	90.95	95.87	97.61	102.72	108.5	111.09	(72)
Total internal gains =						(66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m							
(73)m=	328.8	327.03	317.04	301.1	285.21	269.72	259.55	264.49	272.59	288.7	307.16	320.73	(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)	
South	0.9x	0.3	x	2.6	x	46.75	x	0.53	x	0.7	=	12.18	(78)
South	0.9x	0.3	x	2.6	x	76.57	x	0.53	x	0.7	=	19.94	(78)
South	0.9x	0.3	x	2.6	x	97.53	x	0.53	x	0.7	=	25.4	(78)
South	0.9x	0.3	x	2.6	x	110.23	x	0.53	x	0.7	=	28.71	(78)
South	0.9x	0.3	x	2.6	x	114.87	x	0.53	x	0.7	=	29.92	(78)

South	0.9x	0.3	x	2.6	x	110.55	x	0.53	x	0.7	=	28.79	(78)
South	0.9x	0.3	x	2.6	x	108.01	x	0.53	x	0.7	=	28.13	(78)
South	0.9x	0.3	x	2.6	x	104.89	x	0.53	x	0.7	=	27.32	(78)
South	0.9x	0.3	x	2.6	x	101.89	x	0.53	x	0.7	=	26.54	(78)
South	0.9x	0.3	x	2.6	x	82.59	x	0.53	x	0.7	=	21.51	(78)
South	0.9x	0.3	x	2.6	x	55.42	x	0.53	x	0.7	=	14.43	(78)
South	0.9x	0.3	x	2.6	x	40.4	x	0.53	x	0.7	=	10.52	(78)
Southwest	0.9x	0.3	x	2.4	x	36.79		0.53	x	0.7	=	8.85	(79)
Southwest	0.9x	0.3	x	2.4	x	62.67		0.53	x	0.7	=	15.07	(79)
Southwest	0.9x	0.3	x	2.4	x	85.75		0.53	x	0.7	=	20.62	(79)
Southwest	0.9x	0.3	x	2.4	x	106.25		0.53	x	0.7	=	25.54	(79)
Southwest	0.9x	0.3	x	2.4	x	119.01		0.53	x	0.7	=	28.61	(79)
Southwest	0.9x	0.3	x	2.4	x	118.15		0.53	x	0.7	=	28.4	(79)
Southwest	0.9x	0.3	x	2.4	x	113.91		0.53	x	0.7	=	27.38	(79)
Southwest	0.9x	0.3	x	2.4	x	104.39		0.53	x	0.7	=	25.1	(79)
Southwest	0.9x	0.3	x	2.4	x	92.85		0.53	x	0.7	=	22.32	(79)
Southwest	0.9x	0.3	x	2.4	x	69.27		0.53	x	0.7	=	16.65	(79)
Southwest	0.9x	0.3	x	2.4	x	44.07		0.53	x	0.7	=	10.59	(79)
Southwest	0.9x	0.3	x	2.4	x	31.49		0.53	x	0.7	=	7.57	(79)
West	0.9x	0.3	x	2.6	x	19.64	x	0.53	x	0.7	=	5.12	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.53	x	0.7	=	10.01	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.53	x	0.7	=	16.48	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.53	x	0.7	=	24.03	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.53	x	0.7	=	29.45	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.53	x	0.7	=	30.15	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.53	x	0.7	=	28.71	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.53	x	0.7	=	24.66	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.53	x	0.7	=	19.17	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.53	x	0.7	=	11.87	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.53	x	0.7	=	6.38	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.53	x	0.7	=	4.21	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	26.14	45.02	62.5	78.29	87.98	87.35	84.22	77.07	68.02	50.03	31.41	22.3	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	354.94	372.05	379.54	379.39	373.19	357.06	343.77	341.56	340.62	338.74	338.57	343.03	(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=	1	0.99	0.99	0.96	0.89	0.72	0.53	0.56	0.79	0.96	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	20.27	20.36	20.5	20.7	20.88	20.98	21	21	20.96	20.77	20.49	20.26	(87)

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Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

(88)m=	20.21	20.22	20.22	20.23	20.23	20.25	20.25	20.25	20.24	20.23	20.23	20.22	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	0.99	0.99	0.98	0.95	0.86	0.65	0.44	0.47	0.73	0.94	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	19.24	19.37	19.58	19.88	20.11	20.23	20.25	20.25	20.21	19.97	19.58	19.23	(90)

fLA = Living area ÷ (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.82	19.92	20.1	20.34	20.54	20.65	20.67	20.67	20.63	20.42	20.09	19.81	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.82	19.92	20.1	20.34	20.54	20.65	20.67	20.67	20.63	20.42	20.09	19.81	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.98	0.95	0.87	0.69	0.49	0.52	0.76	0.94	0.99	0.99	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	352.45	368.02	371.86	361.16	326.4	246.21	170.12	177.59	260.25	319.17	333.58	341.05	(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=	682.91	658.75	594.26	491.21	378.19	254.23	170.9	178.67	276.35	419.95	559.78	677.24	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	245.86	195.37	165.46	93.63	38.54	0	0	0	0	74.98	162.86	250.13	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1226.84 (98)

Space heating requirement in kWh/m²/year 23.59 (99)

9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none		0	(301)
Fraction of space heat from community system 1 – (301) =		1	(302)

The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.

Fraction of heat from Community heat pump		1	(303a)
Fraction of total space heat from Community heat pump	(302) x (303a) =	1	(304a)
Factor for control and charging method (Table 4c(3)) for community heating system		1	(305)
Distribution loss factor (Table 12c) for community heating system		1.25	(306)
Space heating		**kWh/year**	
Annual space heating requirement		1226.84	
Space heat from Community heat pump	(98) x (304a) x (305) x (306) =	1533.55	(307a)
Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E)		0	(308

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Space heating requirement from secondary/supplementary system	(98) x (301) x 100 ÷ (308) =	0	(309)

Water heating

Annual water heating requirement		1822.56	
If DHW from community scheme: Water heat from Community heat pump	(64) x (303a) x (305) x (306) =	2278.2	(310a)
Electricity used for heat distribution	0.01 × [(307a)…(307e) + (310a)…(310e)] =	38.12	(313)
Cooling System Energy Efficiency Ratio		0	(314)
Space cooling (if there is a fixed cooling system, if not enter 0)	= (107) ÷ (314) =	0	(315)
Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside		135.44	(330a)
warm air heating system fans		0	(330b)
pump for solar water heating		0	(330g)
Total electricity for the above, kWh/year	=(330a) + (330b) + (330g) =	135.44	(331)
Energy for lighting (calculated in Appendix L)		252.67	(332)
Electricity generated by PVs (Appendix M) (negative quantity)		-337.57	(333)
Electricity generated by wind turbine (Appendix M) (negative quantity)		0	(334)

12b. CO2 Emissions – Community heating scheme

		Energy kWh/year	Emission factor kg CO2/kWh		Emissions kg CO2/year	
CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%)	If there is CHP using two fuels repeat (363) to (366) for the second fuel				319	(367a)
CO2 associated with heat source 1	[(307b)+(310b)] x 100 ÷ (367b) x		0.52	=	620.16	(367)
Electrical energy for heat distribution	[(313) x		0.52	=	19.78	(372)
Total CO2 associated with community systems	(363)…(366) + (368)...(372)			=	639.94	(373)
CO2 associated with space heating (secondary)	(309) x		0	=	0	(374)
CO2 associated with water from immersion heater or instantaneous heater	(312) x		0.52	=	0	(375)
Total CO2 associated with space and water heating	(373) + (374) + (375) =				639.94	(376)
CO2 associated with electricity for pumps and fans within dwelling	(331)) x		0.52	=	70.3	(378)
CO2 associated with electricity for lighting	(332))) x		0.52	=	131.14	(379)
Energy saving/generation technologies (333) to (334) as applicable Item 1		0.52		x 0.01 =	-175.2	(380)
Total CO2, kg/year	sum of (376)…(382) =				666.17	(383)
Dwelling CO2 Emission Rate	(383) ÷ (4) =				12.81	(384)
EI rating (section 14)					90.8	(385)

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User Details:

Assessor Name:		**Stroma Number:**	
Software Name:	Stroma FSAP 2012	**Software Version:**	Version: 1.0.4.26

Property Address: B79_Be Green

Address : The Charlie Ratchford Centre, Belmont Street, LONDON, NW1 8HF

1. Overall dwelling dimensions:

	Area(m²)		Av. Height(m)		Volume(m³)	
Ground floor	52	(1a) x	2.8	(2a) =	145.6	(3a)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n)	52	(4)				
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) =	145.6	(5)

2. Ventilation rate:

	main heating		secondary heating		other		total		m³ per hour	
Number of chimneys	0	+	0	+	0	=	0	x 40 =	0	(6a)
Number of open flues	0	+	0	+	0	=	0	x 20 =	0	(6b)
Number of intermittent fans							2	x 10 =	20	(7a)
Number of passive vents							0	x 10 =	0	(7b)
Number of flueless gas fires							0	x 40 =	0	(7c)

DRAFT

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20	÷ (5) =	0.14	(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 *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*		0	(11)
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)	0.39	(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) =	0.33	(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

0.42	0.41	0.4	0.36	0.35	0.31	0.31	0.3	0.33	0.35	0.37	0.39

Calculate effective air change rate for the applicable case

If mechanical ventilation: 0 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 0 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

(24a)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24a)

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

(24b)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24b)

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

(24c)m=	0	0	0	0	0	0	0	0	0	0	0	0	(24c)

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

(24d)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(24d)

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

(25)m=	0.59	0.58	0.58	0.57	0.56	0.55	0.55	0.55	0.55	0.56	0.57	0.57	(25)

3. Heat losses and heat loss parameter:

ELEMENT	Gross area (m²)	Openings m²	Net Area A ,m²		U-value W/m2K		A X U (W/K)	k-value kJ/m²·K	A X k kJ/K	
Doors Type 1			2.4	x	1.2	=	2.88			(26)
Doors Type 2			2.5	x	1.2	=	3			(26)
Windows Type 1			2.4	x1/[1/(1.4)+ 0.04]		=	3.18			(27)
Windows Type 2			2.6	x1/[1/(1.4)+ 0.04]		=	3.45			(27)
Windows Type 3			2.6	x1/[1/(1.4)+ 0.04]		=	3.45			(27)
Walls Type1	33.32	12.5	20.82	x	0.18	=	3.75			(29)
Walls Type2	11.48	0	11.48	x	0.18	=	2.07			(29)
Roof	52	0	52	x	0.13	=	6.76			(30)
Total area of elements, m²			96.8							(31)

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.53 (33)

Heat capacity Cm = S(A x k) ((28)…(30) + (32) + (32a)…(32e) = 0 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K Indicative Value: Medium 250 (35)

For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.

Thermal bridges : S (L x Y) calculated using Appendix K 4.84 (36)

if details of thermal bridging are not known (36) = 0.05 x (31)

Total fabric heat loss (33) + (36) = 33.37 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 × (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m=	28.26	28.09	27.93	27.18	27.03	26.37	26.37	26.25	26.63	27.03	27.32	27.62	(38)

Heat transfer coefficient, W/K (39)m = (37) + (38)m

(39)m=	61.63	61.46	61.3	60.55	60.4	59.74	59.74	59.62	60	60.4	60.69	60.99

Average = Sum(39)$_{1…12}$ /12= 60.54 (39)

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Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

(40)m=	1.19	1.18	1.18	1.16	1.16	1.15	1.15	1.15	1.15	1.16	1.17	1.17

Average = Sum(40)$_{1\dots12}$ /12= 1.16 (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 1.75 (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 75.74 (43)

Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)													
(44)m=	83.31	80.28	77.26	74.23	71.2	68.17	68.17	71.2	74.23	77.26	80.28	83.31	
										Total = Sum(44)$_{1\dots12}$ =		908.89	(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=	123.55	108.06	111.51	97.22	93.28	80.49	74.59	85.59	86.62	100.94	110.19	119.65	
										Total = Sum(45)$_{1\dots12}$ =		1191.69	(45)
If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)													
(46)m=	18.53	16.21	16.73	14.58	13.99	12.07	11.19	12.84	12.99	15.14	16.53	17.95	(46)

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 150 (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): 1.39 (48)

Temperature factor from Table 2b 0.54 (49)

Energy lost from water storage, kWh/year (48) x (49) = 0.75 (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) 0.75 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

(56)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(56)

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

(57)m=	23.33	21.07	23.33	22.58	23.33	22.58	23.33	23.33	22.58	23.33	22.58	23.33	(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=	23.26	21.01	23.26	22.51	23.26	22.51	23.26	23.26	22.51	23.26	22.51	23.26	(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=	170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	(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=	170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25	

Output from water heater (annual)1…12 | 1740.31 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m]

(65)m=	78.36	69.6	74.35	68.4	68.29	62.84	62.08	65.74	64.87	70.84	72.71	77.06	(65)

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

5. Internal gains (see Table 5 and 5a):

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m=	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	87.45	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
(67)m=	14.31	12.71	10.33	7.82	5.85	4.94	5.34	6.93	9.31	11.82	13.79	14.7	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
(68)m=	152.43	154.01	150.02	141.54	130.83	120.76	114.03	112.45	116.44	124.92	135.63	145.7	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
(69)m=	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	31.75	(69)
Pumps and fans gains (Table 5a)													
(70)m=	3	3	3	3	3	3	3	3	3	3	3	3	(70)
Losses e.g. evaporation (negative values) (Table 5)													
(71)m=	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	-69.96	(71)
Water heating gains (Table 5)													
(72)m=	105.32	103.57	99.94	95	91.79	87.27	83.44	88.35	90.1	95.21	100.99	103.58	(72)
Total internal gains = (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m													
(73)m=	324.29	322.52	312.53	296.59	280.7	265.21	255.04	259.98	268.08	284.19	302.65	316.22	(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)	
South	0.9x	0.3	x	2.6	x	46.75	x	0.63	x	0.7	=	14.47	(78)
South	0.9x	0.3	x	2.6	x	76.57	x	0.63	x	0.7	=	23.7	(78)
South	0.9x	0.3	x	2.6	x	97.53	x	0.63	x	0.7	=	30.19	(78)
South	0.9x	0.3	x	2.6	x	110.23	x	0.63	x	0.7	=	34.13	(78)
South	0.9x	0.3	x	2.6	x	114.87	x	0.63	x	0.7	=	35.56	(78)

South	0.9x	0.3	x	2.6	x	110.55	x	0.63	x	0.7	=	34.22	(78)
South	0.9x	0.3	x	2.6	x	108.01	x	0.63	x	0.7	=	33.44	(78)
South	0.9x	0.3	x	2.6	x	104.89	x	0.63	x	0.7	=	32.47	(78)
South	0.9x	0.3	x	2.6	x	101.89	x	0.63	x	0.7	=	31.54	(78)
South	0.9x	0.3	x	2.6	x	82.59	x	0.63	x	0.7	=	25.57	(78)
South	0.9x	0.3	x	2.6	x	55.42	x	0.63	x	0.7	=	17.16	(78)
South	0.9x	0.3	x	2.6	x	40.4	x	0.63	x	0.7	=	12.51	(78)
Southwest	0.9x	0.3	x	2.4	x	36.79		0.63	x	0.7	=	10.51	(79)
Southwest	0.9x	0.3	x	2.4	x	62.67		0.63	x	0.7	=	17.91	(79)
Southwest	0.9x	0.3	x	2.4	x	85.75		0.63	x	0.7	=	24.51	(79)
Southwest	0.9x	0.3	x	2.4	x	106.25		0.63	x	0.7	=	30.36	(79)
Southwest	0.9x	0.3	x	2.4	x	119.01		0.63	x	0.7	=	34.01	(79)
Southwest	0.9x	0.3	x	2.4	x	118.15		0.63	x	0.7	=	33.76	(79)
Southwest	0.9x	0.3	x	2.4	x	113.91		0.63	x	0.7	=	32.55	(79)
Southwest	0.9x	0.3	x	2.4	x	104.39		0.63	x	0.7	=	29.83	(79)
Southwest	0.9x	0.3	x	2.4	x	92.85		0.63	x	0.7	=	26.53	(79)
Southwest	0.9x	0.3	x	2.4	x	69.27		0.63	x	0.7	=	19.79	(79)
Southwest	0.9x	0.3	x	2.4	x	44.07		0.63	x	0.7	=	12.59	(79)
Southwest	0.9x	0.3	x	2.4	x	31.49		0.63	x	0.7	=	9	(79)
West	0.9x	0.3	x	2.6	x	19.64	x	0.63	x	0.7	=	6.08	(80)
West	0.9x	0.3	x	2.6	x	38.42	x	0.63	x	0.7	=	11.89	(80)
West	0.9x	0.3	x	2.6	x	63.27	x	0.63	x	0.7	=	19.59	(80)
West	0.9x	0.3	x	2.6	x	92.28	x	0.63	x	0.7	=	28.57	(80)
West	0.9x	0.3	x	2.6	x	113.09	x	0.63	x	0.7	=	35.01	(80)
West	0.9x	0.3	x	2.6	x	115.77	x	0.63	x	0.7	=	35.84	(80)
West	0.9x	0.3	x	2.6	x	110.22	x	0.63	x	0.7	=	34.12	(80)
West	0.9x	0.3	x	2.6	x	94.68	x	0.63	x	0.7	=	29.31	(80)
West	0.9x	0.3	x	2.6	x	73.59	x	0.63	x	0.7	=	22.78	(80)
West	0.9x	0.3	x	2.6	x	45.59	x	0.63	x	0.7	=	14.11	(80)
West	0.9x	0.3	x	2.6	x	24.49	x	0.63	x	0.7	=	7.58	(80)
West	0.9x	0.3	x	2.6	x	16.15	x	0.63	x	0.7	=	5	(80)

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

(83)m=	31.07	53.51	74.29	93.06	104.58	103.83	100.11	91.61	80.86	59.48	37.33	26.5	(83)

Total gains – internal and solar (84)m = (73)m + (83)m , watts

(84)m=	355.36	376.03	386.82	389.65	385.28	369.03	355.15	351.59	348.94	343.67	339.98	342.72	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(86)m=	1	0.99	0.99	0.98	0.95	0.85	0.69	0.72	0.9	0.98	0.99	1	(86)

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

(87)m=	19.79	19.89	20.09	20.37	20.64	20.87	20.97	20.96	20.82	20.47	20.09	19.77	(87)

TER WorkSheet: New dwelling design stage

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(88)m=	19.93	19.93	19.94	19.95	19.95	19.96	19.96	19.96	19.96	19.95	19.95	19.94	(88)

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

(89)m=	1	0.99	0.99	0.97	0.92	0.77	0.55	0.58	0.84	0.97	0.99	1	(89)

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

(90)m=	18.33	18.49	18.77	19.18	19.57	19.87	19.95	19.94	19.8	19.34	18.78	18.31	(90)

fLA = Living area ÷ (4) = 0.56 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

(92)m=	19.15	19.28	19.51	19.85	20.17	20.43	20.52	20.51	20.37	19.97	19.51	19.13	(92)

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

(93)m=	19.15	19.28	19.51	19.85	20.17	20.43	20.52	20.51	20.37	19.97	19.51	19.13	(93)

8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation factor for gains, hm:													
(94)m=	0.99	0.99	0.99	0.97	0.93	0.81	0.63	0.66	0.86	0.97	0.99	1	(94)
Useful gains, hmGm , W = (94)m x (84)m													
(95)m=	353.25	372.77	381.11	377.74	357	298.67	223.52	231.67	301.29	331.87	336.37	341.02	(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=	915.09	883.66	797.77	662.82	511.85	348.45	234.22	245.32	376.26	566.24	753.44	910.67	(97)
Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m													
(98)m=	418.01	343.32	310	205.26	115.21	0	0	0	0	174.37	300.3	423.82	

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 2290.29 (98)

Space heating requirement in kWh/m²/year 44.04 (99)

9a. Energy requirements – Individual heating systems including micro-CHP)

Space heating:

Fraction of space heat from secondary/supplementary system		0	(201)
Fraction of space heat from main system(s)	(202) = 1 – (201) =	1	(202)
Fraction of total heating from main system 1	(204) = (202) × [1 – (203)] =	1	(204)
Efficiency of main space heating system 1		93.5	(206)
Efficiency of secondary/supplementary heating system, %		0	(208)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	kWh/year
Space heating requirement (calculated above)													
	418.01	343.32	310	205.26	115.21	0	0	0	0	174.37	300.3	423.82	
(211)m = {[(98)m x (204)] } x 100 ÷ (206)													(211)
	447.07	367.18	331.55	219.53	123.22	0	0	0	0	186.5	321.17	453.29	

Total (kWh/year) =Sum(211)$_{1...5,10...12}$= 2449.51 (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)

TER WorkSheet: New dwelling design stage

Water heating

Output from water heater (calculated above)

170.15	150.15	158.1	142.31	139.88	125.59	121.18	132.19	131.71	147.54	155.28	166.25

Efficiency of water heater 79.8 (216)

(217)m=	87.12	86.95	86.58	85.79	84.3	79.8	79.8	79.8	79.8	85.26	86.54	87.21	(217)

Fuel for water heating, kWh/month

(219)m = (64)m x 100 ÷ (217)m

(219)m=	195.3	172.68	182.61	165.88	165.92	157.38	151.86	165.65	165.05	173.04	179.42	190.64

Total = Sum(219a)$_{1...12}$ = 2065.42 (219)

Annual totals		**kWh/year**	**kWh/year**	
Space heating fuel used, main system 1			2449.51	
Water heating fuel used			2065.42	
Electricity for pumps, fans and electric keep-hot				
central heating pump:		30		(230c)
boiler with a fan-assisted flue		45		(230e)
Total electricity for the above, kWh/year	sum of (230a)…(230g) =		75	(231)
Electricity for lighting			252.67	(232)

12a. CO2 emissions – Individual heating systems including micro-CHP

	Energy kWh/year		**Emission factor** kg CO2/kWh		**Emissions** kg CO2/year	
Space heating (main system 1)	(211)	x	0.216	=	529.09	(261)
Space heating (secondary)	(215)	x	0.519	=	0	(263)
Water heating	(219)	x	0.216	=	446.13	(264)
Space and water heating	(261) + (262) + (263) + (264) =				975.23	(265)
Electricity for pumps, fans and electric keep-hot	(231)	x	0.519	=	38.93	(267)
Electricity for lighting	(232)	x	0.519	=	131.14	(268)
Total CO2, kg/year			sum of (265)…(271) =		1145.29	(272)

TER = 32.34 (273)

A3. CORRESPONDENCE

Grace Wileman

Subject: FW: Redevelopment of the Charlie Ratchford resource centre

From: Davies, James <James.Davies@camden.gov.uk>
Sent: 13 December 2018 15:57
To: Dan Jestico <DJestico@iceniprojects.com>; Berry-Khan, Gabriel <Gabriel.Berry-Khan@camden.gov.uk>
Cc: Thuaire, Charles <Charles.Thuaire@camden.gov.uk>; Nick Grant <NGrant@iceniprojects.com>; Kieron Hodgson <KHodgson@iceniprojects.com>; Mairead Flower <mflower@iceniprojects.com>
Subject: RE: Redevelopment of the Charlie Ratchford resource centre

Hi Dan,

We've just launched our new website and so the link is clearly suffering from a few teething issues.

On the viability of a Kentish Town Network, I can confirm that at present there are no detailed plans for a network which the redevelopment of the Charlie Ratchford site would be able to connect to. The area is of interest, particularly with the density of Camden housing to the north of the development (Denton, St Silas and New Harmood Estates), so it would be prudent and recommended via policy to future proof the development for connection.

I hope that helps, let me know if you need any more information.

Many thanks,

James

James Davies
Senior Sustainability Officer (Low Carbon)

Telephone: 020 7974 6892

From: Dan Jestico <DJestico@iceniprojects.com>
Sent: 13 December 2018 15:32
To: Berry-Khan, Gabriel <Gabriel.Berry-Khan@camden.gov.uk>; Davies, James <James.Davies@camden.gov.uk>
Cc: Thuaire, Charles <Charles.Thuaire@camden.gov.uk>; Nick Grant <NGrant@iceniprojects.com>; Kieron Hodgson <KHodgson@iceniprojects.com>; Mairead Flower <mflower@iceniprojects.com>
Subject: RE: Redevelopment of the Charlie Ratchford resource centre

Dear Gabriel / James,

Many thanks for your prompt response - this is much appreciated. Unfortunately, I don't seem to be able to access the weblink below. Would you be able to email me the report directly?

If James is able to provide me with more detail on the Kentish Town West network, and the potential for connection to this, that would be very helpful.

Kind regards,

Dan.

Dan Jestico CEng MIMechE
Director, Sustainable Development

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mobile: 07584 886 068
email: DJestico@iceniprojects.com

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From: Berry-Khan, Gabriel <Gabriel.Berry-Khan@camden.gov.uk>
Sent: 13 December 2018 14:42
To: Dan Jestico <DJestico@iceniprojects.com>; Davies, James <James.Davies@camden.gov.uk>
Cc: Thuaire, Charles <Charles.Thuaire@camden.gov.uk>; Nick Grant <NGrant@iceniprojects.com>; Kieron Hodgson <KHodgson@iceniprojects.com>; Mairead Flower <mflower@iceniprojects.com>
Subject: RE: Redevelopment of the Charlie Ratchford resource centre

Dear Dan

Many thanks for your approach and I am pleased to help direct you to more information.

In terms of DEN area studies and planning potential, applicants are advised always to consult the Borough Wide District Heat Mapping report: https://www.camden.gov.uk/ccm/cms-service/stream/asset?asset_id=3594902& in addition to the relevant DEN section within Camden Planning Guidance 3 ‘Sustainability’ (CPG3). Note the criteria in the latter for making DEN contributions within a planning scheme.

The best colleague to speak to about the most recent DEN developments would be James Davies (cc), our Low Carbon and energy networks officer.

Best regards,
Gabriel

Gabriel Berry-Khan
Senior Sustainability Officer (Planning)

Telephone: 020 7974 4550

From: Dan Jestico <DJestico@iceniprojects.com>
Sent: 13 December 2018 12:44
To: Berry-Khan, Gabriel <Gabriel.Berry-Khan@camden.gov.uk>
Cc: Thuaire, Charles <Charles.Thuaire@camden.gov.uk>; Nick Grant <NGrant@iceniprojects.com>; Kieron Hodgson <KHodgson@iceniprojects.com>; Mairead Flower <mflower@iceniprojects.com>
Subject: Redevelopment of the Charlie Ratchford resource centre

Dear Gabriel,

I hope you are well.

We are currently working on the redevelopment of the Charlie Ratchford resource centre. I am writing to enquire as to whether there are any planned or existing district heating networks in the vicinity of the site the scheme could be able to connect to. The GLA's London Heat map doesn't show anything nearby.

However, I understand that an assessment of a district heat network potential in Kentish Town West has recently been undertaken, and I was wondering if you might be able to provide me with details on where the network proposals are currently in terms of feasibility, delivery and capacity.

As you're no doubt aware, Policy CC1 sets out that the Council will promote decentralised energy by working with local organisations and developers to implement decentralised energy networks in the parts of Camden most likely to support them. Specifically the policy requires all major developments to assess the feasibility of connecting to an existing decentralised energy network, or where this is not possible establishing a new network.

We are therefore very keen to engage with you at the early stages of the project to ensure we are in the best position to meeting both Camden and GLA policy objectives.

If you or your colleagues would like to meet to discuss the project and district heat network connection feasibility, please let me know.

Kind regards,

Dan.

Dan Jestico CEng MIMechE
Director, Sustainable Development

telephone: 020 3640 1031
mobile: 07584 886 068
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A4. RENEWABLE ENERGY FEASIBILITY ASSESSMENT

A4.1 In line with GLA London Plan requirements, a feasibility assessment of potential renewable energy technologies has been undertaken, and the results from this are presented below.

Technology	Appraisal	Included in Development?
Biomass	This technology is not considered a practical solution to reducing CO_2 emissions, in the view of limited storage space for the combustible material, accessibility of the site for regular deliveries of the material, associated carbon emissions of this technology which are not normally accounted for within energy modelling, and local air quality issues arising from the combustion of biomass material.	✗
Air source heat pump	This technology is deemed appropriate to provide both space and water heating to the proposed dwellings. Full details of the proposed system efficiencies and associated carbon dioxide savings are provided in Section 4. More details on the proposed system are provided below.	✓
Ground source heat pump	This technology is not deemed appropriate as heat is already due to be provided to the scheme by the proposed communal air source heat pump system.	✗
Photovoltaics (PV)	As detailed above in Section 4, the use of PV panels is considered appropriate for this scheme, and its use has been maximised in accordance with the roof space available following the incorporation of roof plant associated with the proposed communal ASHP system. Full details of the proposed PV arrays, areas, locations, outputs and associated carbon dioxide savings are provided in Section 4.	✓

Solar thermal hot water (STHW)	Whilst technically feasible, this technology is rejected on the basis that hot water produced by STHW panels would compete with that provided by the proposed communal ASHP system. In addition, the STHW panels would also compete for roof space with the PV panels detailed above, which are considered to be a more appropriate usage of roof space. This technology is therefore rejected.	✗
Wind turbines	This technology is rejected on the basis of its potential impact on visual amenity and relatively low efficiency from unpredictable, turbulent wind conditions in urban locations.	✗

A4.2 Figure A4.1 below provides more details on the system performance and relevant certification, provided by the system manufacturer.

Figure A4.1 Manufacturer's performance specification of proposed ASHP system

Heating

Product Information

CAHV-P500YA-HPB

Ecodan Air Source Heat Pump

Making a World of Difference

MODEL		CAHV-P500YA-HPB
HEAT PUMP SPACE HEATER - 55°C	ErP Rating	A++
	η_s	125%
	SCOP	3.19
HEAT PUMP SPACE HEATER - 35°C	ErP Rating	A+
	η_s	139%
	SCOP	3.54
HEATING*1 (A-3/W35)	Capacity (kW)	42.6
	Power Input (kW)	15.2
	COP	2.80
OPERATING AMBIENT TEMPERATURE (°C DB)		-20~+40°C
SOUND PRESSURE LEVEL AT 1M (dBA)*2*3		59
LOW NOISE MODE (dBA)*2		Variable
FLOW RATE(l/min)		126
WATER PRESSURE DROP (kPa)		18
DIMENSIONS (mm)	Width	1978
	Depth	759
	Height	1710 (1650 without legs)
WEIGHT (kg)		526
ELECTRICAL SUPPLY		380-415v, 50Hz
PHASE		3
NOMINAL RUNNING CURRENT [MAX] (A)		17.6 [52.9]
FUSE RATING - MCB SIZES (A)*4		63

*1 Under normal heating conditions at outdoor temp: -3°CDB / -4°CWB, outlet water temp 35°C, inlet water temp 30°C
*2 Under normal heating conditions at outdoor temp: 7°CDB / 6°CWB, outlet water temp 35°C, inlet water temp 30°C as tested to BS EN14511
*3 Sound power level of the CAHV-P500YA-HPB is 70.7dBA. Tested to BS EN12102
*4 MCB Sizes BS EN60898-2 & BS EN60947-2

η_s is the seasonal space heating energy efficiency (SSHEE) η_{wh} is the water heating energy efficiency

A5. DOMESTIC OVERHEATING ASSESSMENT

Introduction

A5.1 Policy 5.9 of the London Plan ‘Overheating and Cooling’ seeks to reduce the impact of the urban heat island effect in London and encourages the design of places and spaces to avoid overheating and excessive heat generation and to reduce overheating due to the impacts of climate change and the urban heat island effect on an area wide basis.

A5.2 In order to reduce overheating and reliance on air conditioning, the design of the proposed scheme at Belmont Street has followed the Cooling Hierarchy detailed in Policy 5.9:

1. Minimise internal heat generation through energy efficient design;
2. Reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and walls;
3. Manage the heat within the building through exposed internal thermal mass and high ceilings;
4. Passive ventilation;
5. Mechanical ventilation;
6. Active cooling systems.

Cooling Hierarchy

A5.3 The methods used to minimise overheating and excessive heat generation in line with the cooling hierarchy are outlined below.

Minimisation of internal heat generation through energy efficient design

- Heat gain from lighting is kept to a minimum as a result of an energy-efficient lighting design solution.
- The availability of natural light is maximised by optimising the light transmittance of the glass elements of the façade.
- Heat distribution pipework in communal areas of the residential component will be designed to minimise heat loss.
- HIUs will be positioned in apartments adjacent to corridors and risers to minimise pipework runs within apartments.
- The scheme will use a communal air source heat pump, which is a low temperature distribution system, leading to lower internal heat gains from distribution pipework.

Reduction of the amount of heat entering the building in summer

- The building's facades have a limited amount of glazing to mitigate direct solar heat gain while optimising daylight penetration.

- Façade glazing will use solar control glass to reduce solar gains entering dwellings

- The use of inset balconies and blinds will provide solar shading to apartments, although the overheating mitigation strategy is not dependent on the use of blinds.

Management of the heat within the building through exposed thermal mass and high ceilings

- The proposed green roofs will have a high degree of in-built thermal mass to mitigate heat gain and heat loss.

Passive ventilation

- Openable windows on multiple aspects spaces will provide a passive ventilation strategy that utilises crossflow ventilation to maximise the potential for natural ventilation within the scheme.

- Single aspect dwellings will also have multiple openable windows throughout the façade to provide passive ventilation.

Mechanical and active cooling

- Cooling is not proposed .

Overheating Criteria

A5.4 TM59:2017 is a design methodology for the assessment of overheating risk in homes, published by the Chartered Institution of Building Services Engineers (CIBSE), in April 2017.

A5.5 This is a standardised approach to predict overheating risk for residential building designs using dynamic thermal analysis. It provides a baseline which includes specific weather files, defined internal gains and a set of profiles that represent reasonable usage patterns for a home suitable for evaluating overheating risk. In addition, defined thresholds to provide a pass / fail result are clearly provided as detailed below.

A5.6 Compliance is based on passing both of the following two criteria:

1. For living rooms, kitchen and bedrooms: the number of hours during which the temperature difference between the inside and outside is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours.
2. For bedrooms only: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 22:00 to 07:00 shall not exceed 26 °C for more than 1% of annual hours.

(Note: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, therefore 33 or more hours above 26 °C will be recorded as a fail).

A5.7 Both criteria (1) and (2) above should be met for all relevant rooms.

Methodology

A5.8 The TM59 methodology provides a baseline and guidance for a domestic overheating risk assessment. In line with this methodology, this section includes model inputs used to assess overheating risks to the proposed sample dwellings of the proposed development at Belmont Street.

A5.9 Eight apartments were selected for this overheating risk assessment, which were deemed to be at the highest risk of overheating within the development.

- Third floor. Dwelling C-108. Dual aspect apartment with large area of south facing glazing.
- Fourth floor. Dwelling A-25. Triple aspect apartment with west facing bedroom and east facing living room.
- Fourth floor. Dwelling B-58. Single aspect apartment with large area of south west facing glazing.
- Fourth floor. Dwelling B-59. Single aspect apartment with large area of south west facing glazing.
- Fourth floor. Dwelling C-109. Triple aspect apartment with west/east facing bedrooms and west facing living room.
- Fourth floor. Dwelling C-110. Dual aspect studio apartment with large area of west facing glazing on living room, and limited open area on east façade.
- Ninth floor Dwelling B-78. Dual aspect apartment with large area of south west facing glazing, and limited shading from above.
- Ninth floor Dwelling B-79. Dual aspect apartment with large area of south west facing glazing, and limited shading from above.

A5.10 The images below show the locations of the tested dwellings.

Figure A5.1 Locations of tested dwellings on the third floor

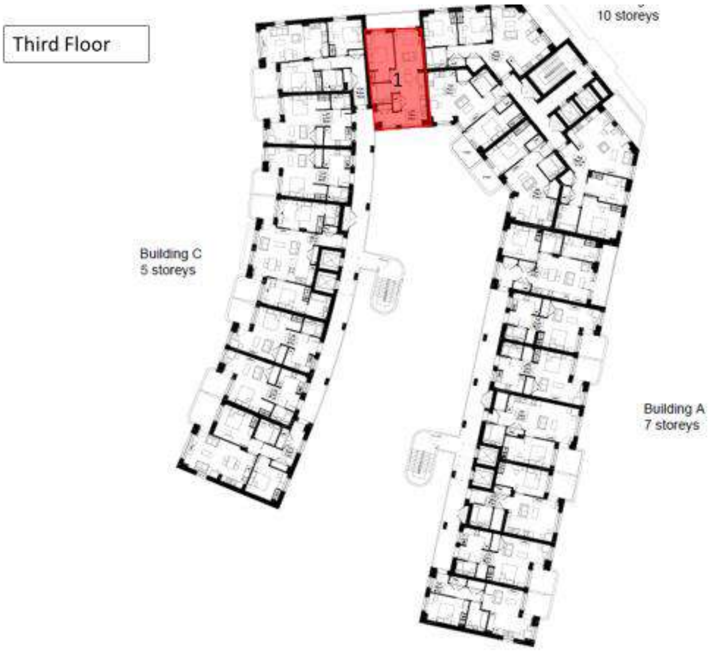

Figure A5.2 Locations of tested dwellings on the fourth floor

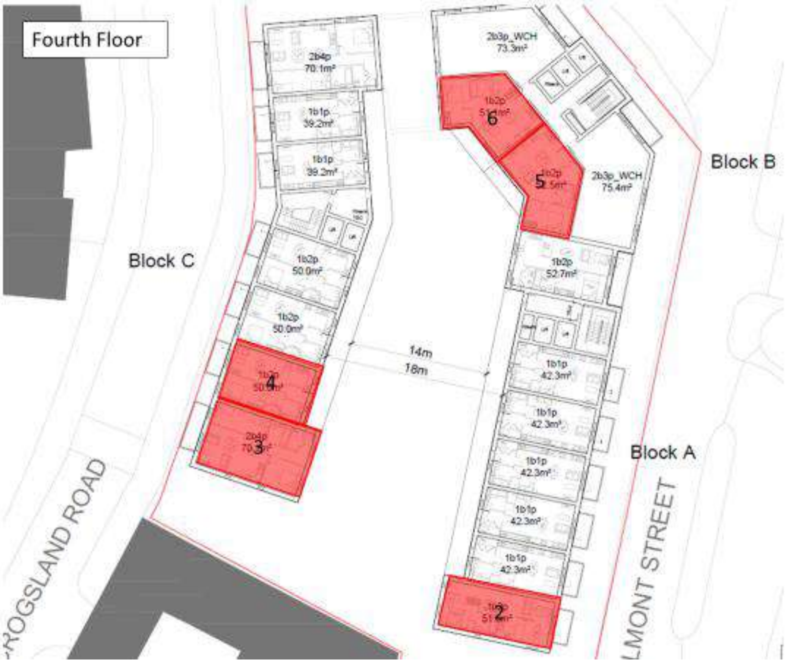

Figure A5.3 Locations of tested dwellings on the ninth floor

A5.11 Dwellings 5, 6, 7 and 8 all have single aspect orientation, all facing south west.

A5.12 All other dwellings are dual or triple aspect.

A5.13 The model was created in EDSL TAS to simulate the internal conditions in each of the occupied spaces highlighted in the above images. The geometry was modelled based on planning submission Issue drawings from HTA Architects.

A5.14 The weather files used for simulation have been based on the guidance contained within CIBSE TM49:2014 (Design Summer Years for London) as follows:

- Design summer year weather file for London Weather Centre, based on an urban location for 1989 (DSY1), has been used on the simulations as required by TM49 methodology. The CIBSE DSY1 represents a moderately warm summer.
- Design summer year weather file for London Weather Centre, based on an urban location for 1976 (DSY2), has been used on the simulations as required by TM49 methodology. The CIBSE DSY2 represents summer with a long period of persistent warmth.
- Design summer year weather file for London Weather Centre, based on an urban location for 2003 (DSY3), has been used on the simulations as required by TM49 methodology. The CIBSE DSY3 represents a summer with a single intense warm spell.

A5.15 The building fabric parameters have been based on the same level of performance as that detailed in the energy strategy. A summary of the thermal envelope values used in the assessment is shown in Table 4.1.

A5.16 In line with the TM59 methodology, the following internal gains and time periods have been employed for this analysis.

Table A5.1 Occupancy heat gains

Room	Sensible heat gain (W/person)	Latent heat gain (W/person)	Occupancy period
Kitchen/Living Room	75	55	Full gains from 9am-10pm
Bedroom	52.5	38.5	70% gains from 11pm to 8am; 100% gains from 8am to 9am and from 10pm to 11pm; 50% gains from 9am to 10pm.

Table A5.2 Equipment heat gains

Room	Heat gain (W)	Occupancy period
Kitchen/Living Room	450 W 200 W 110 W 85 W	6pm to 8pm 8pm to 10pm 9am to 6pm and 10pm to 12pm All other times
Bedroom	80 W 10 W	9am to 11pm All other times
Cupboard	20 W (from heat interface unit)	24 hours

A5.17 A lighting gain of 2 W/m^2 has been applied from 7pm to 11pm to all occupiable rooms.

A5.18 Passive ventilation was modelled based on information provided by HTA Architects as part of the planning submission documentation. The openable windows for each apartment tested were set out as per the drawings provided below in Figure A6.4.

Figure A5.4 Details of opening windows

A5.19 The TM59 methodology states that internal blinds can be included for the analysis only if specifically included in the design, provided in the base build and explained within associated home user guide. In addition, blinds should not be used if they clash with the opening of windows. The proposed overheating mitigation strategy does not rely on the use of internal blinds, and they have not been included as part of this assessment.

A5.20 An infiltration rate of 0.25 air changes per hour has been used for all dwellings, and has been derived from CIBSE Guide A (2015) for a dwelling with an air permeability of $3m^3/hr$ per m^2 @ 50Pa for low rise and high-rise dwellings.

A5.21 Background mechanical ventilation will be provided by MVHR units as required by Part F of the Building Regulations. The ventilation rate included in the model is 1.5 air changes per hour for all rooms.

A5.22 As stated above mechanical cooling is not proposed for the residential elements of the scheme.

Results

A5.23 The table below shows the results of the simulation incorporating the inputs described above.

Table A5.3 DSY1 Results

Room	Criterion 1		Criterion 2		Result
	Max. Exceedable Hours	**Hours Exceeded**	**Max. Exceedable Night Hours**	**Night Hours Exceeded**	**Pass/Fail**
Dwelling 1, Bedroom 1	110	0	32	3	Pass
Dwelling 2, Bedroom 1	110	4	32	3	Pass
Dwelling 3, Bedroom 1	110	9	32	5	Pass
Dwelling 3, Bedroom 2	110	3	32	4	Pass
Dwelling 4, Studio	110	7	32	3	Pass
Dwelling 5, Bedroom 1	110	4	32	3	Pass
Dwelling 6, Bedroom 1	110	10	32	5	Pass
Dwelling 7, Bedroom 1	110	12	32	10	Pass
Dwelling 8, Bedroom 1	110	12	32	7	Pass

Dwelling 1, Living Room/Kitchen	59	3	N/A	N/A	Pass
Dwelling 2, Living Room/Kitchen	59	11	N/A	N/A	Pass
Dwelling 4, Living Room/Kitchen	59	10	N/A	N/A	Pass
Dwelling 5, Living Room/Kitchen	59	0	N/A	N/A	Pass
Dwelling 6, Living Room/Kitchen	59	1	N/A	N/A	Pass
Dwelling 7, Living Room/Kitchen	59	9	N/A	N/A	Pass
Dwelling 8, Living Room/Kitchen	59	8	N/A	N/A	Pass

Table A5.4 DSY2 Results

Room	Criterion 1		Criterion 2		Result
	Max. Exceedable Hours	**Hours Exceeded**	**Max. Exceedable Night Hours**	**Night Hours Exceeded**	**Pass/Fail**
Dwelling 1, Bedroom 1	110	25	32	24	Pass
Dwelling 2, Bedroom 1	110	31	32	29	Pass
Dwelling 3, Bedroom 1	110	31	32	27	Pass

Dwelling 3, Bedroom 2	110	29	32	22	Pass
Dwelling 4, Studio	110	31	32	24	Pass
Dwelling 5, Bedroom 1	110	32	32	26	Pass
Dwelling 6, Bedroom 1	110	30	32	27	Pass
Dwelling 7, Bedroom 1	110	44	32	43	Fail
Dwelling 8, Bedroom 1	110	40	32	40	Fail
Dwelling 1, Living Room/Kitchen	59	33	N/A	N/A	Pass
Dwelling 2, Living Room/Kitchen	59	38	N/A	N/A	Pass
Dwelling 4, Living Room/Kitchen	59	34	N/A	N/A	Pass
Dwelling 5, Living Room/Kitchen	59	29	N/A	N/A	Pass
Dwelling 6, Living Room/Kitchen	59	29	N/A	N/A	Pass
Dwelling 7, Living Room/Kitchen	59	35	N/A	N/A	Pass
Dwelling 8, Living Room/Kitchen	59	35	N/A	N/A	Pass

Table A5.5 DSY3 Results

Room	Criterion 1		Criterion 2		Result
	Max. Exceedable Hours	Hours Exceeded	Max. Exceedable Night Hours	Night Hours Exceeded	Pass/Fail
Dwelling 1, Bedroom 1	110	22	32	17	Pass
Dwelling 2, Bedroom 1	110	34	32	22	Pass
Dwelling 3, Bedroom 1	110	40	32	21	Pass
Dwelling 3, Bedroom 2	110	34	32	17	Pass
Dwelling 4, Studio	110	37	32	18	Pass
Dwelling 5, Bedroom 1	110	35	32	20	Pass
Dwelling 6, Bedroom 1	110	34	32	20	Pass
Dwelling 7, Bedroom 1	110	46	32	32	Pass
Dwelling 8, Bedroom 1	110	46	32	7	Pass
Dwelling 1, Living Room/Kitchen	59	33	N/A	N/A	Pass

Dwelling 2, Living Room/Kitchen	59	49	N/A	N/A	Pass
Dwelling 4, Living Room/Kitchen	59	44	N/A	N/A	Pass
Dwelling 5, Living Room/Kitchen	59	25	N/A	N/A	Pass
Dwelling 6, Living Room/Kitchen	59	28	N/A	N/A	Pass
Dwelling 7, Living Room/Kitchen	59	37	N/A	N/A	Pass
Dwelling 8, Living Room/Kitchen	59	34	N/A	N/A	Pass

A5.24 It can be concluded that all the tested dwellings pass the TM59 overheating criteria for the DSY1 and DSY3 scenarios. However, the bedrooms of dwellings 7 and 8 on the ninth floor are predicted to fail under the DSY2 scenario. The level of exceedance predicted for these bedrooms is 1.3% (43 hours). This compares with a target exceedance of 1.0% (32 hours). The additional 0.3% (11 hours) over the course of a year is not considered to be significant.

A5.25 The building design and building services design have maximised all available measures to minimise heat generation within the dwellings, to reduce the amount of heat entering the building, and to passively and mechanically ventilate the dwellings in line with the cooling hierarchy in Policy 5.9 of the London Plan.

Conclusion

A5.26 This study has shown how the proposed development at Belmont Street has been designed to minimise the risk of overheating. The strategy has followed the cooling hierarchy in Policy 5.9 of the London Plan.

A5.27 TM59:2017 has been adopted for this overheating study as it is the recommended methodology for the assessment of overheating risk in dwellings.

A5.28 The new methodology aims to produce a test that encourages good design that is comfortable within sensible limits, without being so stringent that it over-promotes the use of mechanical cooling.

A5.29 Eight apartments were chosen for this overheating assessment, identified as the dwellings with the highest risk of overheating due to their location, aspects, orientations and glazing ratios.

A5.30 A dynamic thermal model was created in ESL TAS to simulate the internal conditions in each of the occupied spaces within the selected sample dwellings.

A5.31 The modelling incorporated inputs provided within the TM59 methodology guidance and information provided by HTA Architects.

A5.32 The building design and building services design have maximised all available measures to minimise heat generation within the dwellings, to reduce the amount of heat entering the building, and to passively and mechanically ventilate the dwellings in line with the cooling hierarchy in Policy 5.9 of the London Plan.

A5.33 The results were then compared to the CIBSE TM59 overheating criteria for the three weather files specified in CIBSE TM49. It can be concluded that all dwellings pass the TM59 overheating criteria for the DSY1 and DSY3 weather files. For the DSY2 scenario, failures are predicted for two of the eight bedrooms tested. However, the extent of the failure is not significant, with a 1.3% exceedance of target temperatures, compared with the guidance target exceedance of 1.0%.

A5.34 If overheating was found to be an issue in future for these dwellings, the following mitigation measures should be explored:

- Retrofitted solar control film to minimise solar gain
- Additional external shading to limit solar gain
- Improved blinds to reduce solar gain
- Increased MVHR flow rates for additional purge ventilation
- Use of free standing fans
- Ventilation grilles for ground floor dwellings

A6. GENERAL NOTES

A6.1 The report is based on information available at the time of the writing and discussions with the client during any project meetings. Where any data supplied by the client or from other sources have been used it has been assumed that the information is correct. No responsibility can be accepted by Iceni Projects Ltd for inaccuracies in the data supplied by any other party.

A6.2 The review of planning policy and other requirements does not constitute a detailed review. Its purpose is as a guide to provide the context for the development and to determine the likely requirements of the Local Authority.

A6.3 No site visits have been carried out, unless otherwise specified.

A6.4 This report is prepared and written in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in guidance may necessitate a re-interpretation of the report in whole or in part after its original submission.

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